

Thermo Scientific

**EPD TruDose G**

**EPD TruDose BG**

**EPD TruDose NG**

**User Handbook**

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Release history: see [“Manual Revision History”](#) on page xiv

## WEEE Directive

2012/19/EU



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## WEEE Direktive

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## Preface

**IMPORTANT This EPD TruDose™ User Handbook applies to the EPD TruDose Mark 3.0 or higher (until superseded by a newer version of this manual).**

The EPD TruDose User Handbook is for the Thermo Fisher Scientific EPD TruDose models as follows:

- EPD TruDose-BG, the Beta – Gamma Version
- EPD TruDose-G, the Gamma only version
- EPD TruDose-NG, the Neutron- Gamma Version
- For further information, see “EPD Types” on [page 1](#).

This manual is split into the following chapters

### Chapters

- [Chapter 1, “Introduction to EPD TruDose™”](#)
- [Chapter 2, “Getting Started with EPD TruDose™”](#)
- [Chapter 3, “Operating Instructions for EPD TruDose™”](#)
- [Chapter 4, “LCD Display for the EPD TruDose™”](#)
- [Chapter 5, “Maintenance for the EPD TruDose™”](#)

The Appendices in the manual give details regarding the specifications of the EPD as follows:

### Appendices

- [Appendix A, “Technical Description”](#)
- [Appendix B, “Physical Characteristics of the EPD”](#)
- [Appendix C, “Radiological Specifications”](#)
- [Appendix D, “Environmental Specifications”](#)
- [Appendix E, “In Built Integrity Checks”](#)
- [Appendix F, “EPD Faults and Recovery Actions”](#)

## Related Documentation

The following table lists Thermo Scientific Handbooks related to the use of the EPD TruDose™:

- EasyEPD3 User Handbook 43100/1060-04
- Desktop Reader User Handbook 43600/1050-04
- The software also provides Help.

## Manual Revision History

Version	Date	Name	Section(s)	Revision comments	Approval
1.0	February 2017	Norbert Trost	All	First Issue P# 01/2017	
1.1	June 2018	Norbert Trost	All		
1.2	July 2018 (ECN 81571)	Norbert Trost	Table19 various Table25A Figure 37	No scratch pad NiMH rechargeable Response Meaningful values	
1.3	September 2018 (ECN 81592)	Norbert Trost	Table25A All	Ranges Minor Edits	
1.4	February 2019	Norbert Trost	Table 13 Page 45 Page 92 Page 95	Battery Lifec Version screen Pulsed radiation Firmware Checksum	ECN 81530
1.4.2	May 2019	Norbert Trost	Page 58	LTC Batteries	ECN 83170
1.4.3	January 2020	Alexander Itzke	Page 45 Page 100	Firmware Checksum Confidence Test	ECN 83432
1.4.4	July 2020	Reinh. Buchhold	Page 9	Lanyard deleted	ECN 83604
1.5.0	January 2021	N.Trost, A. Itzke	Page 1, 2, 3, 6, 37, 42, 45-47, 51, 61-63, 91, 92 94	TruDose-NG added	ECN 83728

## Safety and Special Notices

Make sure you follow the cautions and special notices presented in this guide. Cautions and special notices appear in boxes; those concerning safety or possible system damage also have corresponding caution symbols.

This guide uses the following types of cautions and special notices.



**CAUTION:** Highlights hazards to humans, property, or the environment. Each CAUTION notice is accompanied by an appropriate CAUTION symbol.

**IMPORTANT:** Highlights information necessary to prevent, loss of data, or invalid test results; or might contain information that is critical for optimal performance of the system.

**Note:** Highlights information of general interest.

**Tip:** Highlights helpful information that can make a task easier.

## Contacting Us

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# Introduction to EPD TruDose™

This section gives an introduction to EPD TruDose™.

## Contents

- “EPD Types” on page 1
- “General Description of the EPD” on page 1
- “Major Characteristics of the EPD” on page 3
- “
- External Features of the EPD” on page 5

## EPD Types

Currently, the following EPD TruDose™ types are available:

- **EPD TruDose-G** measures personal dose equivalents Hp(10) and Hp(0,07) from Gamma sources.
- **EPD TruDose-BG** measures personal dose equivalents Hp(10) and Hp(0,07) from **Beta** and Gamma sources.
- **EPD TruDose-NG** measures personal dose equivalents Hp(10) from Gamma and **Neutron** sources

**Note:** To simplify nomenclature the term EPD has been used throughout this handbook for all matters that apply to all EPD TruDose™ types; whereas EPD TruDose-BG or EPD TruDose-G or EPD TruDose NG are used for matters specific to each of these types.

## General Description of the EPD

All Dosimeters provide an estimate of the radiation Dose and Dose Rate that the person wearing the EPD has received. Radiation that is detected by the EPD is processed to give an indication of Dose and Dose Rates. This information is displayed to the user via an LCD display on the top of the EPD (see “LCD Display” on page 36).

See “Detectors and Processing” on page 64 for further information.

## EPD Identity Data

Certain fields are configured into EPDs during the Manufacturing Process and are not adjustable by the customer. They are dependent upon the model of EPD supplied, the identity of major parts used in the manufacture of the EPD and whether it is used for particular process in manufacturing, i.e. reference standard units. These fields can be read from a suitable IR Communications link such as EasyEPD3.

These fields comprise:

**Table 1. EPD Identifiers**

Field	Description
EPD Serial Number	Each EPD is allocated a unique Serial Number. This number is written on the EPD case as a number and QR code.
EPD Type	Identifies the Type of the EPD e.g. EPD TruDose-BG, EPD TruDose-G, EPD TruDose NG etc.
Mk No.	The Mark number is used to track the build state of each EPD model and operates independently for each model. The Mark number is increased whenever there is a significant change introduced into the design or manufacture of the EPD model in question.
Model Name	EPD Model name e.g. TruDose-BG, TruDose-G, TruDose NG
EPD Part No.	EPD Part number 43000xxxx for -BG, 43010xxxx for -G and 43021xxxx for -NG.
PCB Serial No.	Serial number for the EPD's main PCB.
PCB Part No.	Part number for the EPD's main PCB.
FEM Serial No.	Identifies the Front End Module Serial Number.
Firmware Part No.	Part number for the loaded MCU firmware.
Firmware Version	Version number for the loaded MCU firmware.
Golden EPD	Designation of EPD's used by Thermo Fisher as reference standard units. They are recognized within Thermo Fisher manufacturing systems and are protected against calibration change.
<b>Note: The following Fields are Read Only and are part of the Factory Calibration process:</b>	
Detector Sensitivities	See “ <a href="#">Detector Sensitivities</a> ” on <a href="#">page 64</a> for more information.
Detector Thresholds	See “ <a href="#">Detector Thresholds</a> ” on <a href="#">page 65</a> for more information.

## Dose Display Units

Dose Display can be set to Sievert or REM. See “[User Interface](#)” on [page 82](#) for further information.

**Note:** This manual deals with Sievert (Sv) throughout. To convert to REM, multiply all values by 100.



## EPD Measurement quantities

The EPD measurement quantities provided by the EPD Types are:

**Table 2.** EPD Measurement quantities

EPD Type	Hp(10)	Hp(0,07)
EPD TruDose-G	✓	✓ excluding Beta component
EPD TruDose-BG	✓	✓ including Beta component
EPD TruDose-NG	✓ including Neutron component	

For these, the EPD also provides Total Doses, Dose Rate and Peak Dose Rate (and date/time) measurements.

**Note** All measurements applicable to an EPD Type are available via the LCD Display. However, what is provided on the LCD display depends upon the EPD configuration, and typically only a subset is provided, according to customer needs and preferences. See “[EPD Menu Navigation Displays](#)” on [page 32](#).

## Major Characteristics of the EPD

The Major Characteristics relating to the EPD are listed in [Table 3](#) below:

**Table 3.** EPD Major Characteristics

Feature	Characteristic
Power	One AA battery, either a standard Alkaline (1.5 V) battery or NiMH (1.2 V) rechargeable or high energy Lithium Thionyl Chloride (LTC) (3.6 V). See “ <a href="#">The EPD Battery</a> ” on <a href="#">page 57</a> for more information.
Weight	106 g (including LTC battery and clip).
Dimensions	85.5 x 63 x 21mm (excluding clip).
Multiple alerts of Alarm Conditions	LED, Sounder and Vibe (see “ <a href="#">Alarm Indicators</a> ” on <a href="#">page 24</a> ).
EEPROM storage of detected radiation	Dose and events are stored to non-volatile memory.
RFI	High immunity to radio frequency interference (RFI).
Backlight	Display Backlight (see “ <a href="#">Operation of the Backlight</a> ” on <a href="#">page 24</a> ).
IR Communications	EPD communication via an infrared interface up to a range of approximately 1 meter (see “ <a href="#">Communicating with the EPD</a> ” on <a href="#">page 75</a> ).
User Interface	Comprising graphic, dot matrix LCD Display and two user buttons (see “ <a href="#">LCD Display for the EPD TruDose™</a> ” on <a href="#">page 32</a> ).
Dose Profile	Collection of up to 1792 records with programmable interval and dose resolution (see “ <a href="#">Dose Profile</a> ” on <a href="#">page 81</a> ).
Stay Time Remaining / Return For Read	Stay Time Remaining and Return For Read Alarm use the same LCD Display. (see “ <a href="#">Stay Time Remaining / Return for Read</a> ” on <a href="#">page 41</a> ).

See “[Physical Characteristics of the EPD](#)” on [page 84](#) for further information.

## External Features of the EPD

The EPD is of rugged construction and is suitable for most conditions that can reasonably be expected in the following environments.

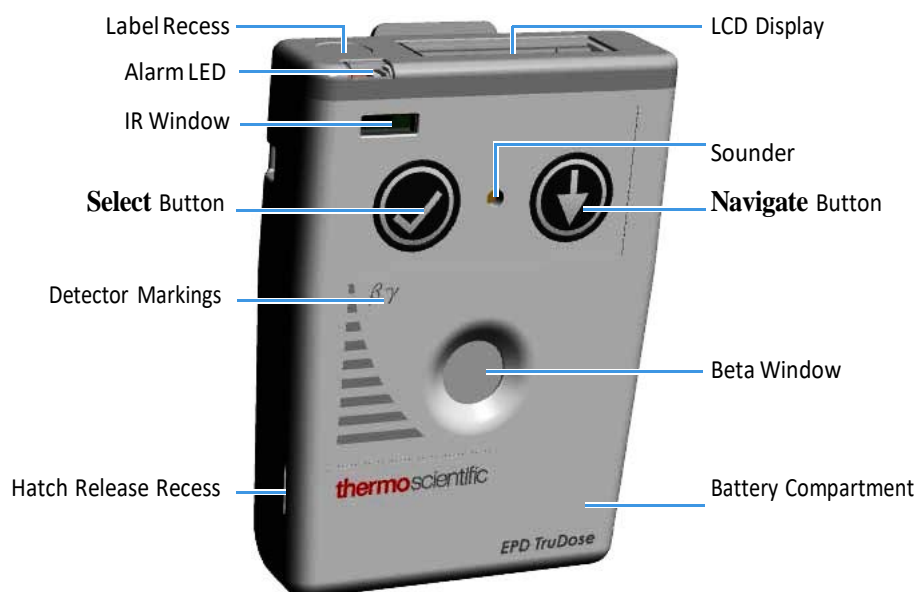
- Office and Laboratory environment,
- Industrial environments,
- Medical environments
- Military environments

The EPD is a sealed unit and will withstand short periods of immersion in water but is not designed for prolonged immersion under pressure. Refer to [“Environmental Specifications”](#) on [page 96](#) for information regarding IP ratings.

The complete assembly is engineered to house functional and operation components as shown in [Figure 1](#) and [Figure 2](#). External features are described in [Table 4](#).

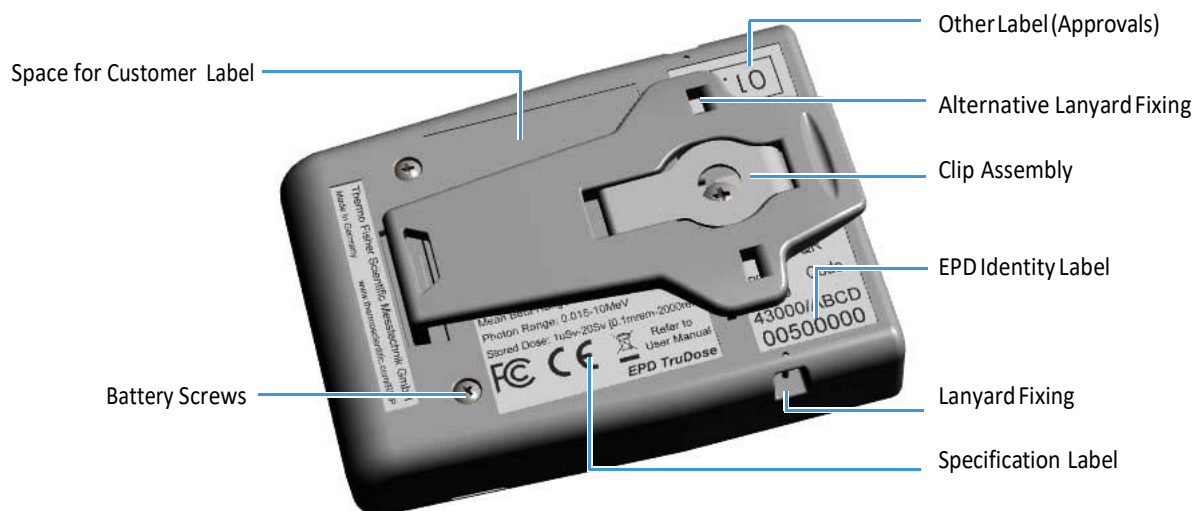
[Figure 3](#) shows a simplified drawing of the EPD indicating the Detector Centers.

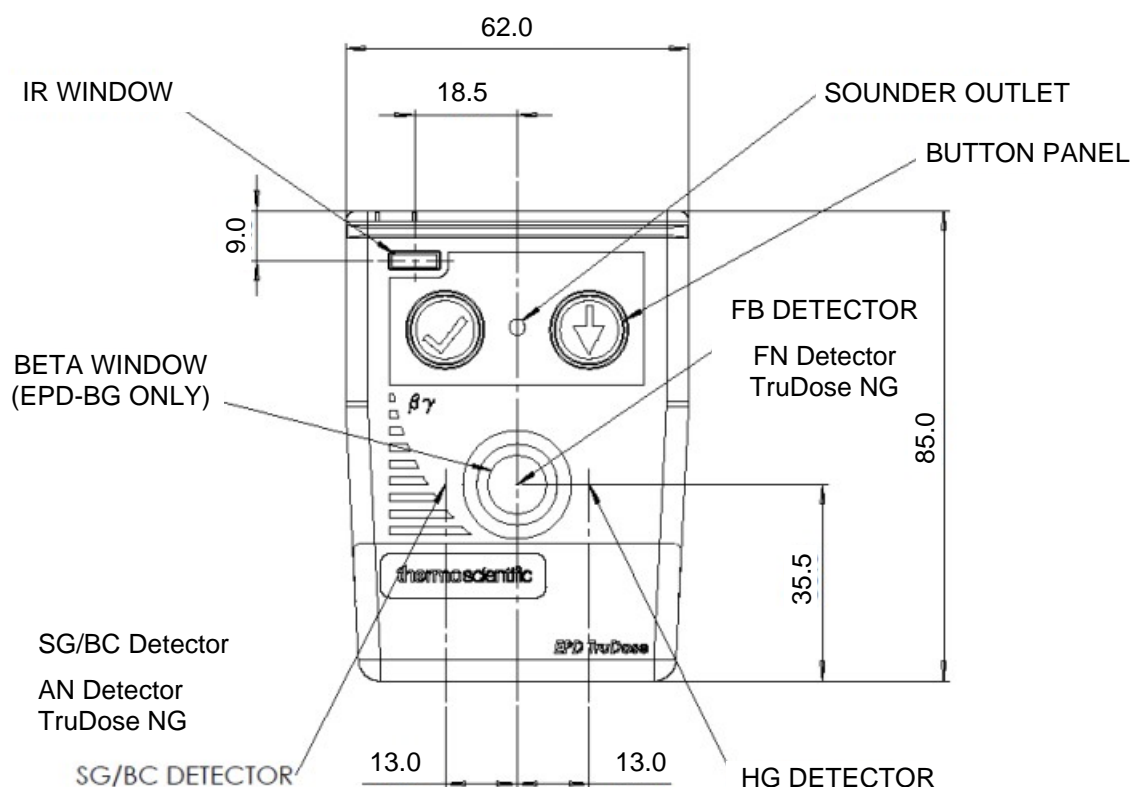
**Figure 1.** Front View of the EPD



**Note:** The EPD TruDose-G is similar except the beta window is replaced by a plastic dome.

**Figure 2.** Rear View of The EPD



**Figure 3.** Simplified Drawing of EPD showing Detector Centers**Table 4.** EPD External Features

Feature	Description
Label Recess	The Label Recess allows the user to make use of off-the-shelf stickers to visually identify EPDs. For example, different colored stickers could be used to identify Calibration Months or “Emergency-Use” EPDs.
LCD Display	The LCD Display shows EPD parameters and/or functionality as selected by the buttons. See <a href="#">“LCD Display”</a> on <a href="#">page 36</a> .
Alarm LED	The Alarm LED provides a visual indication of an EPD alarm. A high intensity LED is provided with 2 levels of brightness. LED is visible from the top and the front. See <a href="#">“Alarm Indicators”</a> on <a href="#">page 24</a> .
IR Window	The IR Window provides a high speed communication path to/from the EPD. See <a href="#">“Communicating with the EPD”</a> on <a href="#">page 75</a> .
<b>Select and Navigate</b> Buttons	These buttons provide a user interface for EPD control, alarm acknowledgment and LCD display selection. See <a href="#">“Select and Navigate Buttons”</a> on <a href="#">page 20</a> .
Detector Markings	The Detector Markings will indicate the EPD Type as follows: <ul style="list-style-type: none"> <li>• <math>\beta\gamma</math> - Beta/Gamma unit</li> <li>• <math>\gamma</math> - Gamma- only unit</li> </ul>

Feature	Description
	See <a href="#">Appendix C, “Radiological Specifications”</a> .
Hatch Recess	Recess to allow user to open the Battery Compartment after releasing the Battery Hatch screws.
	See <a href="#">“EPD Battery Installation”</a> on <a href="#">page 14</a>
Sounder	The Sounder provides an audible indication of an EPD alarm.
	See <a href="#">“Alarm Indicators”</a> on <a href="#">page 23</a> .
Beta Window	The Beta Window is centered over the detector (EPD TruDose-BG unit only). See <a href="#">Figure 3</a> .
Battery Compartment	The Battery Compartment houses a Mignon (AA) cell.
	See <a href="#">“EPD Battery Installation”</a> on <a href="#">page 14</a> .
Lanyard Fixing and Alternative Lanyard Fixing	The Lanyard Fixings provides a means of attaching a Lanyard to the EPD. See <a href="#">Figure 2</a> .
	See <a href="#">“EPD Lanyard Assembly (if required)”</a> on <a href="#">page 12</a> .
Labels	<ul style="list-style-type: none"> <li>· EPD Identity Label displays Thermo Fisher information, such as EPD Id, EPD Type, EPD Mk No etc.</li> <li>· Specification Label display Mean Beta Range, Photon Energy Range and Stored Dose Information, plus other markings.</li> <li>· Other Labels, as required.</li> <li>· Space for Customer Label.</li> </ul>
	See <a href="#">“System Integration Facilities”</a> on <a href="#">page 89</a> .
Clip Assembly	The Clip Assembly provides a means of attaching the EPD to Clothing.
	See <a href="#">“EPD Clip Assembly”</a> on <a href="#">page 10</a> .
Battery Screws	Battery Screws to attach the Battery Compartment. These are “captive” screws -so should not be lost.
	See <a href="#">“EPD Battery Installation”</a> on <a href="#">page 14</a> .
Detectors	SG, FB and HG Detectors.
	See <a href="#">“Detectors and Processing”</a> on <a href="#">page 64</a>





## Getting Started with EPD TruDose™

This section describes how to get your EPD TruDose ready for use.

### Contents

- [“EPD Out of the Box Setup”](#) on page 10
- [“Wearing an EPD”](#) on page 17

## EPD Out of the Box Setup

The EPD requires very little set-up. Set up is primarily confined to:

1. [“Unpacking the EPD”](#) on page 10
2. [“EPD Clip Assembly”](#) on page 10
3. [“EPD Lanyard Assembly \(if required\)”](#) on page 12
4. [“EPD Battery Installation”](#) on page 14

## Unpacking the EPD

There are no special unpacking instructions.

The EPD will be shipped with the following:

- Clip (see [“EPD Clip Assembly”](#) on page 10)
- If supplied, a battery - may be a LTC or Alkaline or NiMH type, according to customer requirements (see [“EPD Battery Installation”](#) on page 14)
- Quick Start Guide

## EPD Clip Assembly

The clip assembly comprises a clip (moving part), custom steel spring and fixing screw, which allows the user to attach the EPD to an outer garment. See [“Wearing an EPD”](#) on page 17 for more information.

## Rear Clip Assembly

The rear clip is fixed to the EPD using only one screw. This makes it easily replaceable, plus each part of the clip is able to be detached and is replaceable.

The clip is sized so it will fit onto a 40mm wide belt and latch under preventing it from riding off un-noticed.

The clip has been designed to ensure both the plastic and the spring will endure repeated operation as well as mild abuse, without damage. In the event of the clip being deliberately forced open, the clip plastic will break before any damage is done to the EPD.

Additional Lanyard Fixings are available in the clip plastic (see [“EPD Lanyard Assembly \(if required\)”](#) ) on [page 12](#) below).

**Figure 4.** Rear Clip Assembly



The case back is flat when the clip is not fitted as shown in [Figure 5](#).

**Figure 5.** Rear Clip not fitted



### Front Clip Assembly

For those users who wish to wear the EPD in their shirt pocket without the rear clip fitted, there is the optional front clip (part number: 43100/1001-13). This slides over the EPD and grips the shirt pocket material providing security and preventing the EPD sliding out when the user bends down. Consult your Health Physicist or Radiation Protection Supervisor before wearing an EPD inside a pocket, as doing so will cover the  $\beta$  window.

**Figure 6.** Front Clip Assembly



The display can still be read, and the alarm LED remains visible. Just slide the clip off when the EPD needs to be put into a Reader.

**Figure 7.** Front Clip Assembly View (in situ)



### EPD Lanyard Assembly (if required)

The EPD lanyard allows the user to wear the EPD around their neck. See [“Wearing an EPD”](#) on [page 17](#) for more information.

Note that the lanyard has an emergency release mechanism at the back of the neck that will separate the lanyard in case of entrapment.

**❖ To attach a Lanyard to the EPD**

1. Using just the “string” end, pass the end of the Lanyard through the fixing (either on the side of the EPD or the Clip) and loop through on itself. Repeat the process with the second “string” end.

**Note:** You may need to use tweezers and a magnifying glass to assist you.

**Figure 8.** Attaching the Lanyard



2. Clip the Lanyard together.

**Figure 9.** Completed Lanyard

**❖ To remove a Lanyard from the EPD**

1. Unclip the Lanyard and unloop the “string” end from the fixing.

## EPD Battery Installation



### GENERAL PRECAUTIONS AND INSTRUCTIONS REGARDING THE EPD TRUDOSE BATTERY

EPD Batteries are susceptible to fire and abuse. Some manufacturers provide batteries with a safety vent, which allows a controlled release of electrolyte if fire and abuse conditions prevail. If the EPD has been damaged in a manner that could affect the battery, care must be exercised during battery removal. The battery may have vented into the EPD case and caused the EPD to become pressurized.

Always fit new undamaged batteries of the correct type.

See “The EPD Battery” on page 57 for further information regarding EPD Battery types (including Lithium Thionyl Chloride Batteries) and maintenance.

### ❖ To Insert/Replace the EPD Battery

To set up the EPD for operational use, the battery must be inserted/replaced in accordance with the following procedure:

1. Read and observe the “GENERAL PRECAUTIONS AND INSTRUCTIONS REGARDING THE EPD TRUDOSE BATTERY” on page 14.
2. Remove the battery hatch from the case as described below.
3. Unscrew the two M2 screws to release the hatch as shown in Figure 10.

**Note:** The screws are “captive” to the Casing. Only undo sufficiently to release the hatch.

**Figure 10.** Unscrew Battery Hatch



4. After prolonged use in a dirty environment, dirt may get into the joints. This may make removal of the battery hatch difficult. A recess at either side of the hatch allows a finger nail or small flat-blade screwdriver to be used to pop the hatch as shown in Figure 11. Reminder: Loosen screws prior to opening.

**Figure 11.** Housing Recess

5. Remove the existing battery (if fitted). Insert a new (or replacement) battery into the battery compartment as shown in [Figure 12](#).

**Figure 12.** Inserting the EPD Battery

6. The battery area is marked for battery orientation as shown in [Figure 13](#). If the battery is inserted incorrectly, moulding features prevent connection and thus avoid possible damage to the EPD electronics.
7. If the battery is fitted cleanly and contact is given, the software initialization process starts immediately.



**Figure 13.** Battery Area Markings



8. Replace the battery hatch, fitting the lower edge of the hatch with case front first and then hinging into the closed position as shown in [Figure 14](#).

**Figure 14.** Fitting the Battery Hatch



Do not overtighten, it should only be necessary to bring the hatch down flush with the case front.

9. Screw the two M2 (or security) screws to secure the hatch as shown in [Figure 10](#).

10. Following fitment of a battery, the EPD will begin a Confidence Test (see “



11. [Confidence Test](#)” on [page 101](#)). Once the Confidence Test is complete, the “[Default Display](#)” on [page 28](#) will appear or the configured Off display if the EPD was off before the battery change (see “[Off Mode Displays](#)” on [page 52](#)).

For more information on how to use the EPD, see “[Operating Instructions for EPD TruDose™](#)” on [page 20](#).

## Wearing an EPD

The EPD should be worn under the direction of the Health Physicist. For most operating conditions, it is recommended that the EPD be worn on the outside of any protective clothing (see [Figure 15](#) to [Figure 18](#) below). Note that the EPD should be facing forward, with the buttons facing outwards.

Wearing the EPD on the outside of protective clothing has the major advantage that the user can read the EPD’s LCD display and operate the buttons as required. Typically, the EPD should be worn on the chest or the waist, facing forward. The type of outer protective clothing will determine how the EPD is attached (i.e. the EPD clip or lanyard). For example, if the protective clothing has no breast pocket (or the use of a belt is prohibited) the lanyard may be the most practical method of wearing the EPD.

When the EPD is worn on the outside of protective clothing, to minimize the risk of contamination of the EPD, consideration should be given to wearing the EPD in a suitably-sealed plastic bag.

**Note:** Consult your Health Physicist or Radiation Protection Supervisor before wearing an EPD inside a pocket or under clothing. This will cover the  $\beta$  window and will remove the Beta component from the measurement. Eyes and not protected skin may be exposed to Beta radiation.

Although the EPD case is designed to be decontaminated (see “[Radiological Cleaning](#)” on [page 61](#)), in contaminated areas, consideration should be given to possible entrapment in less accessible areas, such as under the clip or in the sounder chamber.

The same applies if an EPD is worn inside a divers suit close to the body.

**Figure 15.** EPD worn outside breast pocket (using Rear Clip)



**Figure 16.** EPD worn inside breast pocket (using Front Clip) not suggested for BG units



See “Front Clip Assembly” on [page 12](#) for more information

**Figure 17.** EPD worn on belt (using Rear Clip)



**Figure 18.** EPD worn on lanyard around the neck





## Operating Instructions for EPD TruDose™

This section explains the essential functions performed by the EPD TruDose and describes operating instructions that will allow the user to display data, acknowledge alarms and operate the EPD.

### Contents

- “Select and Navigate Buttons” on page 20
- “Button Operation during Off/On Mode” on page 22
- “LCD Display” on page 23
- “Operation of the Backlight” on page 24
- “Alarm Indicators” on page 23
- “Display Configurations” on page 28

## Select and Navigate Buttons

The **Select** and **Navigate** buttons enable the user to move through the menus. The **Navigate** button has a down facing arrow icon and the **Select** button has a check mark icon.

**Figure 19.** Select and Navigate Buttons



Select



Navigate/Next

The buttons are tactile membrane keys that provide a click to the user.

Almost all functionality is accessed using simple Short-Click<sup>1</sup> button presses.

<sup>1</sup> Defined as a press and release, where the period that the button is pressed for is between 200 ms and 2 seconds.

## Navigating through the Menu Options

When in the Menu System, pressing **Navigate** moves to the next item at the current menu level and pressing **Select** enters the sub level.

At the end of each level, there is a Back option which will return the user to the previous level of menu, or to the Default Display in the case of the top level (see “Default Display” on page 28).

If no buttons are pressed during the Timeout, the display will revert to the Default Display.

Prior to reverting to the Default Display from a Measurement Display the “Pin?” prompt will be displayed (see “Pin Screen to Current Display” on page 29) to allow the user to keep the current measurement display.

If Hp(10) Dose is the default display this feature may be used to keep the dose rate display permanent until acknowledged.

If an Alarm Condition is detected by the EPD during the navigation of the menus, the display will revert to the Default Display and Alarm Notification immediately. This allows the user to respond to the alarm before reentering the menu navigation to resume the previous task (see “Muting the Alarm” on page 27).

See “EPD Menu Navigation Displays” on page 32 for a full list of Menu options.

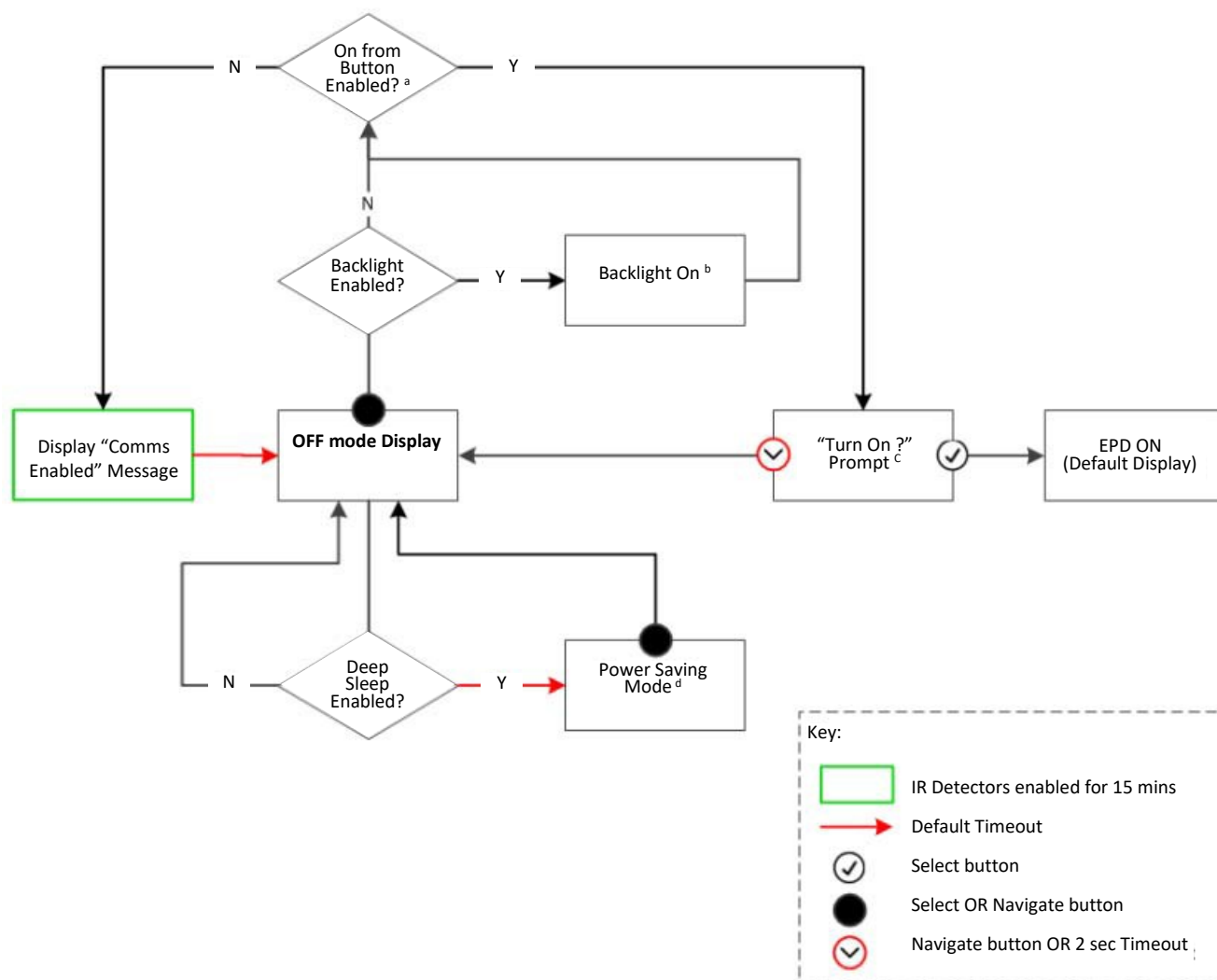
## Button Operation during Off/On Mode

### During EPD Off Mode

**Note:** For further information regarding Off Mode, see “On and Off Operating Modes” on page 71.

When the EPD is in Off Mode, the action of the buttons is as shown in Figure 20.

**Figure 20.** EPD Interaction in OFF Mode



a) On from Button Enabled, see “Comms Active Prompt” on page 49

b) Backlight On, see “Operation of the Backlight” on page 24

c) Turn On Prompt, see “EPD ON” on page 49

d) Power Saving Mode, see “On and Off Operating Modes” on page 71

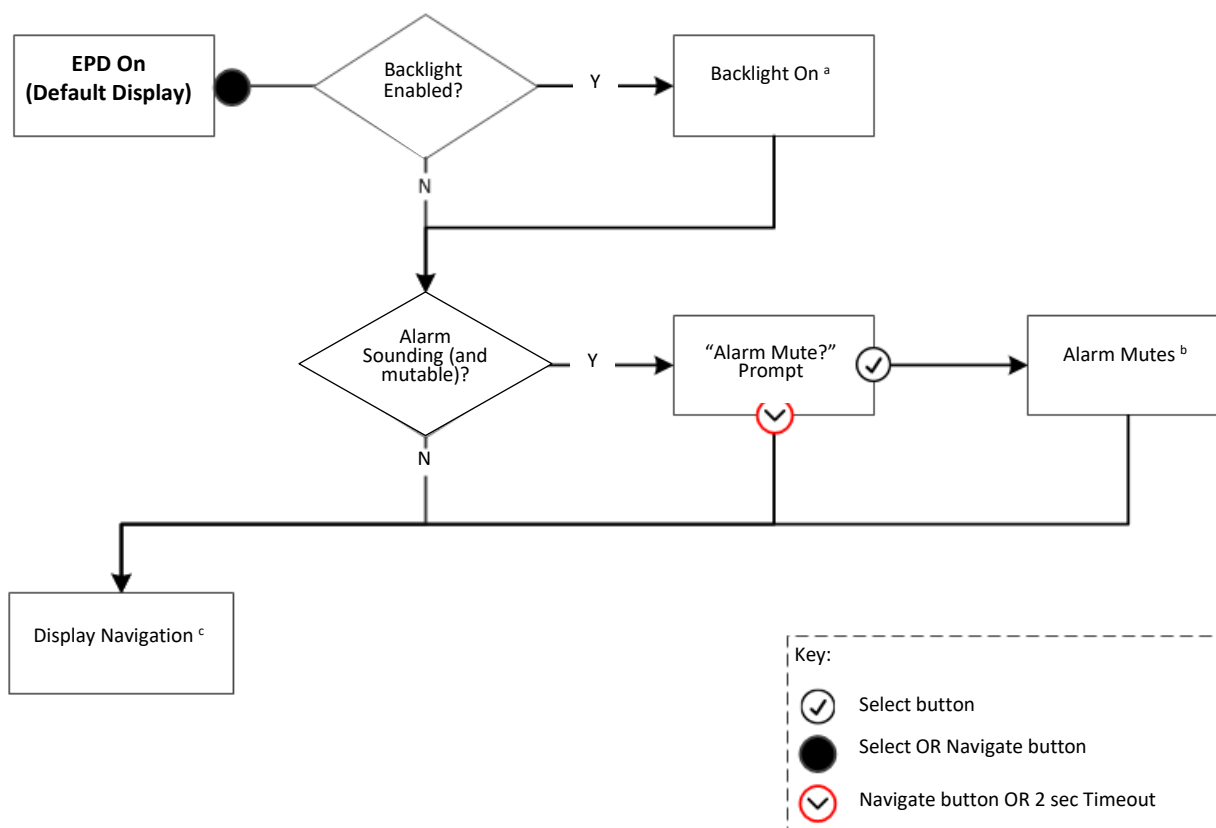
## During EPD On Mode

**Note:** For further information regarding On Mode, see “On and Off Operating Modes” on page 71.

When the EPD is in On Mode, the action of the buttons is as show in Figure 21.

N

**Figure 21.** EPD Interaction in ON Mode



- a) Backlight On, see “Operation of the Backlight” on page 24  
 b) Alarm Mutes, see “Muting the Alarm” on page 27  
 c) Display Navigation, see “EPD Menu Navigation Displays” on page 32

## LCD Display

A LCD display on the top of the EPD provides a visual interface for viewing Dose and other EPD data. On completion of the start-up sequence or *Confidence Test* (see “Run Confidence Test” on page 47), the Default Display will appear (see “Default Display” on page 28).

For more information, see “LCD Display for the EPD TruDose™” on page 32.

## Operation of the Backlight

**Note:** Backlight options can only be configured via the IR Communications link (see “[User Interface](#)” on [page 82](#)).

The EPD is equipped with a display backlight to enable the display to be read in darker environments.

If the Backlight is enabled, the first press of a button (while the display is turned on) will turn on the backlight. The backlight will remain lit for the configured On Period. Any subsequent button press will extend the backlight On period. See “[Backlight Display Characteristics](#)” on [page 90](#) for settings.

In order to reduce load on the battery, when the Backlight is turned on:

- If the Alarm is sounding:
  - Quiet Alarms will continue
  - Loud Alarms will become Quiet
- Alarm LED will reduce to low intensity
- The Alarm flags will still be displayed on the LCD
- Normal alarm indications via the LCD shall continue

## Alarm Indicators



**Warning:**

The Alarm LED can be set to very bright and the Sounder can be set to very loud. Prolonged exposure to these should be avoided.

The EPD has three alarm indicators as follows:

- |                      |   |
|----------------------|---|
| · Sounder            | Several pre-programmed sequences and 2 volume levels.                               |
| · LED (Ultra bright) | Operation at 2 brightness levels, runs in sequence with the Alarm Tone and Pattern. |
| · Vibe Motor         | Runs in sequence with the Alarm Tone and Pattern.                                   |

These indicators are activated when certain alarm conditions occur. Each indicator can be individually enabled or disabled for each alarm condition.

It is possible to enable/disable the Sounder, LED and/or Vibe as required, but alarm flags on the LCD will remain until the condition is normalized. The Sounder can be configured for a more quiet operation, for example, in office or hospital environments.

The EPD can be configured into Covert Mode, which will automatically disable the Alarm Indicators, see “[Covert Mode](#)” on [page 73](#) for further information.



Note that certain operations and events will automatically turn off Alarm Indicators for a short period, because of the high electrical power required, as follows:

**Table 5.** Operation/Event where Alarm Indicators are momentarily turned off

Operation or event	Typical mute period
Communication over the IrDA link	1 second or more, depending upon the application
Communications over the teledosimetry link	Less than 1 second
Battery test (typically every 15 minutes)	Less than 1 second

See “[Configurable Alarm Characteristics](#)” on [page 25](#) for settings.

## Configurable Alarm Characteristics

The EPD initiates alarms depending on operational conditions. The nature of the alarm is shown on the LCD display by an alarm flag (see “[Notification Displays](#)” on [page 51](#)).

There are a number of options that can be set for each alarm. Note that the Sounder, LED, Vibe and mute options can only be configured via the IR Communications link (see “[User Interface](#)” on [page 79](#)). The configurations can be set independently for each alarm event.

The Alarm Type and Pattern are shown in “[Alarm Type / Pattern Definitions](#)” on [page 26](#).

### Alarm Durations

When an alarm is activated and is the highest current priority alarm, the alarm will sound for the minimum continuous duration (unless set to zero in which case the alarm will be continuous).

Once a configurable alarm continuous duration has elapsed, the alarm ceases continuous operation and reverts to producing a 2 second burst of the alarm once every 30 seconds.

### Alarm Priorities

It is possible for more than one alarm condition to prevail at any one time. In this event, the sounder output is determined by the highest priority prevailing alarm. Alarms are prioritised as defined in [Table 6](#).

An active alarm can be superseded by the following events:

- A higher priority alarm is activated (the new alarm starts).
- The user mutes alarms (see “[Muting the Alarm](#)” on [page 27](#)).
- Alarms are cleared via the IR Communications links (see “[EPD Configuration via the IR Communications Link](#)” on [page 77](#)).
- A self-cancelling condition de-activates the alarm (e.g. falling Dose Rate).

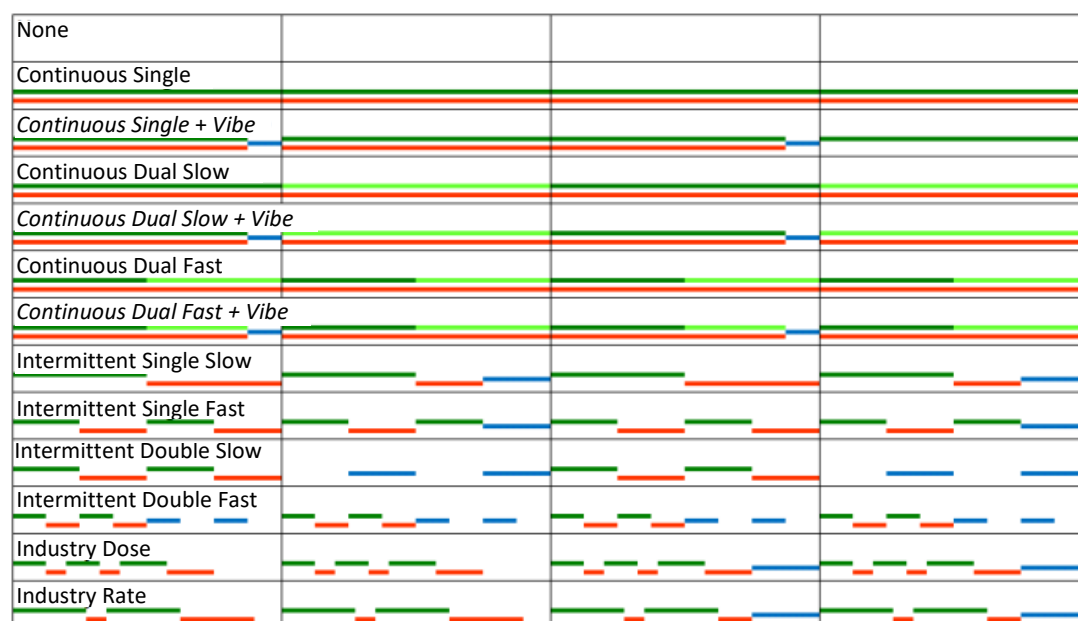
The 14 alarms in the system, listed in order of priority with default Alarm Type, are shown in Table 6:

**Table 6.** Alarm Types

Priority	Alarm/Event
1	Failure Alarm
2	Dose or Dose Rate Overrange <sup>a</sup>
3	Measurement quantity Dose Alarm <sup>a</sup>
4	Abuse Alarm
5	Measurement quantity Dose Rate Alarm <sup>a</sup>
6	Measurement quantity Dose Warning <sup>a</sup>
7	Measurement quantity Dose Rate Warning <sup>a</sup>
8	Battery Low Warning
9	Return for Read

<sup>a</sup> See “Dose and Dose Rate Alarm Thresholds” on page 69

**Figure 22.** Alarm Type / Pattern Definitions



Key:

Dark Green = High Tone (Enabled/Quiet/Loud)

Light Green = Low Tone (Enabled/Quiet/Loud)

Light Red = LED (Enabled/Dim/Bright)

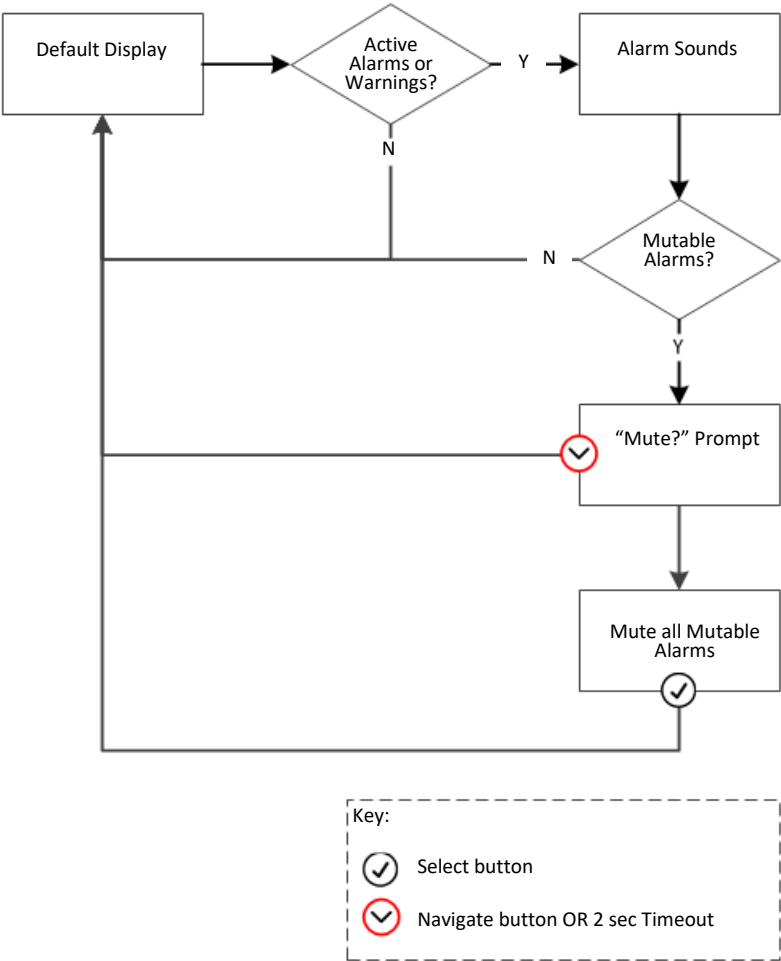
Blue = Vibe (if enabled)

The borders represent one second boundaries, e.g. “Continuous Dual Slow” represents one second High Tone alternating one second Low Tone

## Muting the Alarm

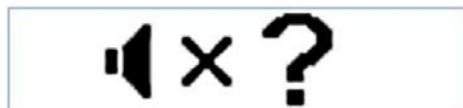
If Alarm Muting is enabled for any of the currently active alarms, the action of the buttons is as shown in [Figure 23](#):

**Figure 23.** Mutable Alarms



❖ **To mute any Mutable Alarms:**

1. If Alarm Muting is enabled for any of the currently active alarms (see [“Notification Displays”](#) on [page 51](#)), then pressing **Navigate** while the alarm is sounding will initiate a mute Prompt on the display:

**Figure 24.** Mute Alarm Prompt Display

2. The Mute Alarm Prompt will be displayed for a maximum of 2 seconds before the prompt is removed and the display reverts to showing the Notification Alarms Display with the alarm still sounding.  
If, during the display of the mute prompt:
  - **Select** is pressed, then any active mutable alarms will be muted and the display will return to the Default Display, which will alternate with the Notification Alarms Display.
  - **Navigate** is pressed, then the behavior is as if the 2 second timeout occurred, alarms are not muted and the display shows the Notification Alarms Display sequence.
3. Acknowledgment of alarms shall be recorded in the Event Log (see [“Event History”](#) on [page 81](#)).
4. If an acknowledged alarm condition is cleared and subsequently re-raised, then the alarm condition is sounded again.
5. After acknowledging all mutable alarms, any non-mutable alarms are sounded.

See [“Alarm Notification”](#) on [page 52](#) for more information regarding Muted and Non-Muted Alarms.

## Display Configurations

### EPD Menu Display Navigation

The displays available to the user can be configured by an administrator to restrict the available displays to just a small subset of the available displays. See [“EPD Menu Navigation Displays”](#) on [page 32](#) for further information.

### Default Display

The Default Display is the default operational display following a period of inactivity of the buttons. It is factory preset to read measurement quantity 1 Dose (Hp10 Dose), or to an alternative Default Display in accordance with the customer selected configuration.

The Default Display can also be changed by the customer after delivery using the IR Communications link (see [“EPD Configuration via the IR Communications Link”](#) on [page 77](#)).

Only measurement displays can be assigned as the Default Display (see [“Measurement Displays”](#) on [page 38](#)).

## Quick Access

There are up to 5 Quick Access Displays. Initially, the Default Display is shown (see “Default Display” on page 28).

- Pressing **Navigate** will cycle through the Quick Access displays. The last entry in the Quick Access list will be the Menu option. Pressing **Select** while this is displayed (if enabled) will switch to the Menu Navigation display (see “EPD Menu Navigation Displays” on page 32).
- Pressing **Select** from any of the Quick Access displays will transition to the Menu option.

If the Menu option is disabled, then **Select** from any of the Quick Access displays will navigate to the Default Display.

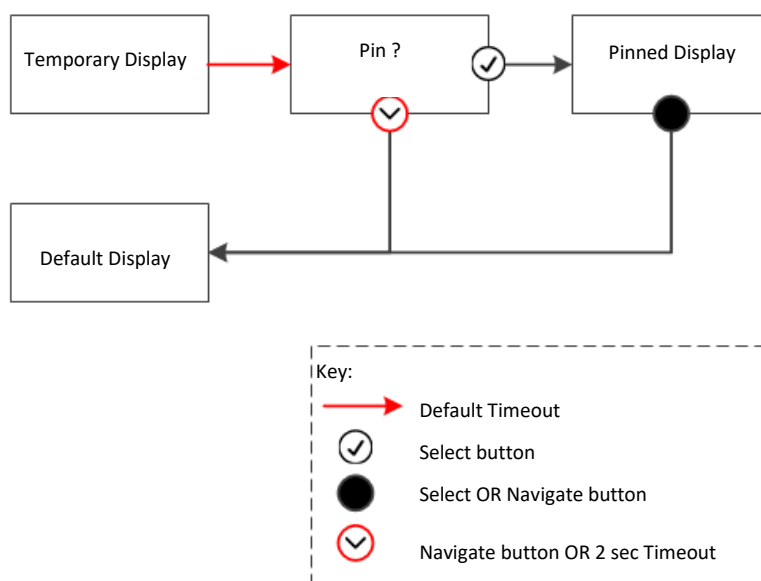
**Note:** The only displays that cannot be added to the Quick Access display are the “Run Confidence Test” on page 47 and “Alarm Test” on page 47.

## Pin Screen to Current Display

The Pin Display utility allows the user to fix the currently selected display, thereby inhibiting the return to the Default Display until a further button press is made. Only measurement displays will support Pinning as the Current Display (see “Measurement Displays” on page 38).

When Pin is selectable, the action of the buttons is as show in Figure 25:

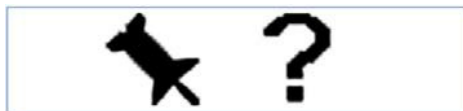
**Figure 25.** Display Pinning



#### ❖ To Pin the currently selected Display

1. When a user has selected a display other than the Default Display either from the Quick Access display set or the Menu system, this temporary display is shown only for the default timeout before it reverts back to the Default Display.
2. When the Temporary Display Timeout expires, a prompt to “Pin” is shown for 2 seconds:

**Figure 26.** Pin Display



3. If during this time, the user presses **Select**, the display is “Pinned” until either button is pressed again. A “Pin” icon flashes in the top right hand corner to indicate that this is a Pinned Display. The Display remains pinned until **Select** or **Navigate** is pressed again, which will cause the display to revert to the Default Display.

**Figure 27.** Pinned Display



**Note:** In example above, the display is pinned on the Hp10 Dose Rate display.

4. If **Navigate** is pressed (or once the 2 second timeout occurs), then the display reverts to the Default Display.



## LCD Display for the EPD TruDose™

This chapter describes the displays that are available in the EPD TruDose.

### Contents

- “Introduction to LCD Display” on page 32
- “EPD Menu Navigation Displays” on page 32
- “LCD Display” on page 36

## Introduction to LCD Display

The EPD TruDose is provided with many different displays which can be configured to suit different end user requirements. These configuration options are explained in “[EPD TruDose Communications via IR Link](#)” on page 74 but the user can also refer to the EasyEPD3 User Manual (see “[Related Documentation](#)” on page xiv) which describes each parameter in more detail and how they are accessed.

## EPD Menu Navigation Displays

See “[Select and Navigate Buttons](#)” on page 20 for more information on how to use the buttons to navigate through the menus.

Note that the Top Menus show the title of the menu. For each sub-menu display, it is the actual data that is shown. For example, in the Top Level Menu called “Diagnostics”, the item that shows Voltages under the Top Menu will actually show the voltages display. Pressing **Navigate** will change the display to the counters display.

**IMPORTANT: The user may have access to all, some or none of the displays, depending on how the EPD has been configured. If all the displays in a sub-menu are disabled, then the corresponding entry in the top level menu will also be disabled. See “[EPD Configuration via the IR Communications Link](#)” on page 77.**



Table 7 shows a full list of Displays associated with the Top Level Menu and Figure 28 on page 35 shows a pictorial representation of the menu display.

**Table 7.** EPD Displays

Top Menu	Display	For more information, see section....
Operations	Turn On/Off	“EPD OFF” on page 49 and “EPD ON” on page 49
	Clear Dose	“Clear Dose” on page 50
	Telemetry On/Off	“Telemetry On/Off” on page 50
	Dose Trigger On	“Trigger Responder Dose Accumulation” on page 51
Measurement quantity (e.g. Hp10, Hp07 depending on “EPD Types” on page 1)	Dose	“Dose” on page 39
	Triggered Dose	“Triggered (Responder) Dose” on page 39
	Dose Rate	“Dose Rate” on page 40
	Dose Alarm Threshold	“Dose and Dose Rate Warning and Alarm Thresholds” on page 42
	Dose Warning Threshold	“Dose and Dose Rate Warning and Alarm Thresholds” on page 42
	Dose Rate Alarm Threshold	“Dose and Dose Rate Warning and Alarm Thresholds” on page 42
	Dose Rate Warning Threshold	“Dose and Dose Rate Warning and Alarm Thresholds” on page 42
	Total Dose	“Total Dose” on page 40
	Peak Dose Rate	“Peak Dose Rate” on page 41
Assignment	Issue State & Wearer Name	“Issue State and Wearer Identification” on page 43
	Graphic Wearer Name	“Graphic Wearer Name” on page 44
	Issue State & Wearer ID (1, 2 and 3)	“Issue State and Wearer ID” on page 44
	Task Name	“Task Name” on page 45
	Task ID	“Task ID” on page 44
Remaining	Stay Time Remaining / Return for Read	“Stay Time Remaining / Return for Read” on page 41
	Dose Margin Used	“Dose Margin Used” on page 42
Diagnostics	Display Voltages	“Voltages” on page 46
	Display Counter	“Counters” on page 46
	Display EPD Version	“EPD Firmware Version Information” on page 46

Top Menu	Display	For more information, see section....
	Calibration Due Date	<a href="#">“Calibration Due Date”</a> on page 47
	Run Confidence Test	<a href="#">“Run Confidence Test”</a> on page 47
	Alarm Test	<a href="#">“Alarm Test”</a> on page 47
N/A	Active Alarms	<a href="#">“Alarm Notification”</a> on page 52
	Active Warnings	<a href="#">“Warning Notification”</a> on page 52
	Active Overrange	<a href="#">“Overrange Alarm Notification”</a> on page 53
	Critical Fault	<a href="#">“Critical Failure Notification”</a> on page 53

**Figure 28.** Display Navigation

TOP MENU		DISPLAY	
Default Display			
Quick Display 1 to 5*			
*depending on configuration		<b>Menu</b>	
		<b>Operations</b>	On / Off
			Clear Dose
			Telemetry On/Off
			Responder On
			Back
	<b>Hp(10), Hp(0,07)</b>	Dose	
		Triggered Dos	
		Dose Rate	
		Dose Alarm Thresh	
		Dose Warn Thresh	
		Rate Alarm Thresh	
		Rate Warn Thresh	
		Total Dose	
		Peak Rate	
		Back	
	<b>Assignment</b>	Wearer Name	
		Graphic Wearer Name	
		Wearer Primary ID	
		Wearer ID2	
		Wearer ID3	
		Task Name	
		Task ID	
		Back	
	<b>Remaining</b>	Stay Time Remaining	
		Dose Margin Used	
		Back	
	<b>Diagnostics</b>	Voltages	
		Counters	
		Version information	Info 2 Info 3
		Cal Due Date	
		Confidence Test	
		Alarm Sound Test	
		Back	
	<b>Back</b>		

⬇️ Navigate/Next button – Down

⬆️ Select button – Across

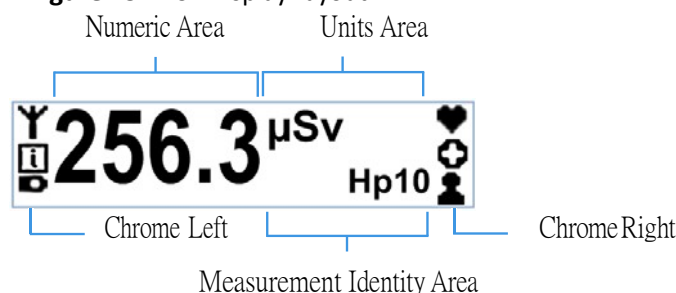
Menu	⬆️	Navigates to Operations Menu
	⬇️	Navigates to Default Display
Back	⬆️	Navigates to Default Display
	⬇️	Navigates to Operations Menu
Back	⬆️	Navigates to top menu of section
	⬇️	Navigates to first display of section

Display	⬆️	Action confirmation required:
	⬇️	Performs Action
Display	⬆️	Remains on current display
	⬇️	Remains on current display

## LCD Display

The display is a monochrome graphic LCD. The display is split into the following areas:

**Figure 29.** LCD Display Layout



- “Chrome Areas (Left and Right)” on page 36
- “Numeric Area” on page 37
- “Units Area” on page 38
- “Measurement Identity Area” on page 38

### Chrome Areas (Left and Right)

The Chrome Areas are laid out with 3 icon positions, as follows:

**Table 8.** Chrome Layout

Position	Left	Right
Top		
Centre		
Bottom		

Where:

- **Top Left** location is the Telemetry indications:<sup>1</sup>

	Telemetry Enabled	<u>Flashing</u> Antenna
	Telemetry Connected	<u>Solid</u> Antenna
	Telemetry Transmitting	Double Headed Arrow
- **Centre Left** location has the Latched Alarm and Warning indicators:
 

	Latched but Inactive Warning	“i” in Information Box
	Latched but Inactive Alarm	“!” in Warning Triangle

NOTE If the Alarm indicator is active, the Warning indication is not shown.

<sup>1</sup> Note that this icon changes to a warning triangle if there is a radio failure

- **Bottom Left** location has the Battery State indication:



Battery Level

Battery shown, Half Full, Outline (empty)

- **Top Right** location has the Heartbeat or Pin indicators that will slowly flash:



Heartbeat

Flashing Heart



Pin

Flashing Pin

- **Centre Right** has the Responder and Pulse Mode indications:



Responder

Cross in circle

NOTE: When the Responder Mode has been triggered, the cross will alternate with its inverse. If the EPD is in Pulse and Responder Mode, the Pulse icon will alternate with the inverse Responder icon.



Pulsed Mode Enabled

Digital pulse



Covert Mode Enabled

Loudspeaker with line through

- **Bottom Right** location has the Issued State indicator:



Issued State

Head and Shoulders (Wearer)

## Numeric Area

The Numeric Area displays the numeric value as 4 digits and one decimal place, e.g. 123.4, 1.234.

There are several configuration options for the EPD that affect the exact format of the numeric data displayed:

- Display Units (Sv or rem)
- $\mu$ Sv inhibit (Doses shown in Sv and mSv only)
- Limit to 2 Decimal Points
- Show Trailing Zeros

See “[User Interface](#)” on [page 82](#) for further information.

## Units Area

The Units Area of the display will show the current units depending on the Measurement Value.

- Sv
- mSv
- $\mu$ Sv
- Sv/h
- mSv/h
- $\mu$  Sv/h
- rem
- mrem
- rem/h
- mrem/h

## Measurement Identity Area

The Measurement Identity Area displays the Dose Display measurements, see [“Measurement Displays”](#) on [page 38](#).

- Hp(10) displays as “Hp10” (Hp10G and HP10N for Gamma and Neutron component with -NG)
- Hp(0,07) displays as “Hp07”
- Total Dose displays as “Σ”
- Peak Dose Rate displays as “Pk”

## Display Types

There are 4 categories of display:

- “Measurement Displays” on [page 38](#)
- “Static Data Displays” on [page 42](#)
- “Functional Control Displays” on [page 48](#)
- “Notification Displays” on [page 51](#)

## Measurement Displays

Measurement Displays shows measurement or time related information that varies over time.

Only Measurement Displays will be capable of being configured to be the Default Display (see [“Default Display”](#) on [page 28](#)).

Only Measurement Displays can be Pinned as the Current Display (see [“Pin Screen to Current Display”](#) on [page 29](#)).

## Dose

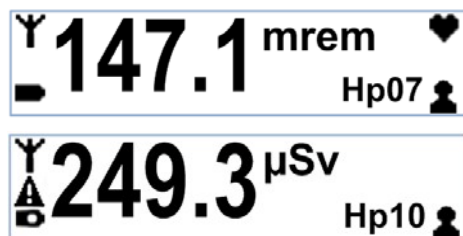
The Dose display shows a single measurement value along with the current units and an indication of the measurement quantity. See “Dose and Total Dose” on page 67 for a full description of Dose.

### ❖ To display measurement quantity Dose

1. If the measurement quantity Dose display is set to be the Default Display, this is displayed on the LCD (see “Default Display” on page 28).
2. If the measurement quantity Dose display is set in the Quick Access displays (see “Quick Access” on page 29), press **Navigate** until measurement quantity Dose is displayed.
3. Otherwise,

**Navigate** or **Select** to *Menu* > **Select** > **Navigate** to *measurement quantity* > **Select** to Dose

**Figure 30.** Dose Displays



## Triggered (Responder) Dose

The Triggered Dose is exactly the same as the Dose display with the addition of the flashing Responder icon in the Chrome Area. Triggered Dose shows zero dose until it is triggered, after which it accumulates normally. See “Responder Mode” on page 73 for further information.

### ❖ To display measurement quantity Triggered Dose (Responder)

1. If the measurement quantity Dose display is set to be the Default Display, this is displayed on the LCD (see “Default Display” on page 28).
2. If the measurement quantity Dose display is set in the Quick Access displays (see “Quick Access” on page 29), press **Navigate** until measurement quantity Dose is displayed.
3. Otherwise,

**Navigate** or **Select** to *Menu* > **Select** > **Navigate** to *measurement quantity* > **Select** > **Navigate** to Triggered Dose

**Figure 31.** Triggered Dose Display



## Dose Rate

The Dose Rate display is similar to the Dose display with the following differences:

- Units have a “/h” appended.
- Values will be rounded to 2 or 3 significant digits

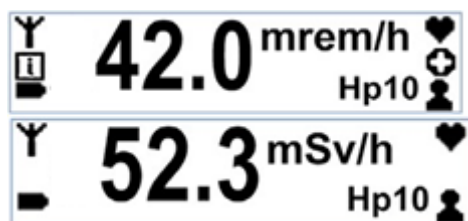
See “Dose Rate” on page 68 for a full description of Dose Rate.

### ❖ To display measurement quantity Dose Rate

1. If the measurement quantity Dose Rate display is set to be the Default Display, this is displayed on the LCD (see “Default Display” on page 28).
2. If the measurement quantity Dose Rate display is set in the Quick Access displays (see “Quick Access” on page 29), press **Navigate** until measurement quantity Dose Rate is displayed.
3. Otherwise,

**Navigate** or **Select** to *Menu* > **Select** > **Navigate** to *measurement quantity* > **Select** > **Navigate** to Dose Rate

**Figure 32.** Dose Rate Display



## Total Dose

The Total Dose display is the same as the main Dose Display with the addition of “Σ” in the Measurement Identity Area. See “Dose and Total Dose” on page 67 for a full description of Total Dose.

### ❖ To display measurement quantity Total Dose

1. If the measurement quantity Total Dose display is set to be the Default Display, this is displayed on the LCD (see “Default Display” on page 28).
2. If the measurement quantity Total Dose display is set in the Quick Access displays (see “Quick Access” on page 29), press **Navigate** until measurement quantity Total Dose is displayed.
3. Otherwise,

**Navigate** or **Select** to *Menu* > **Select** > **Navigate** to *measurement quantity* > **Select** > **Navigate** to Total Dose

**Figure 33** Total Dose Display





## Peak Dose Rate

The Peak Dose Rate display is the same as the Dose Rate display with the addition of “Pk” in the Measurement Identity Area. See “Peak Dose Rate and Time” on page 68 for a full description of Peak Dose Rate.

### ❖ To display measurement quantity Peak Dose Rate

1. If the measurement quantity Peak Dose Rate display is set to be the Default Display, this is displayed on the LCD (see “Default Display” on page 28).
2. If the measurement quantity Peak Dose Rate display is set in the Quick Access displays (see “Quick Access” on page 29), press **Navigate** until measurement quantity Peak Dose Rate is displayed.
3. Otherwise,

**Navigate** or **Select** to *Menu* > **Select** > **Navigate** to *measurement quantity* > **Select** > **Navigate** to Peak Dose Rate.

**Figure 34.** PeakDoseRateDisplay



## Stay Time Remaining / Return for Read

**Note:** The Stay Time Remaining and Return for Read share this display configuration.

The Stay Time Remaining / Return for Read icon is as displayed.

### ❖ To display Stay Time Remaining / Return for Read

1. If the Stay Time Remaining / Return for Read is set to be the Default Display, this is displayed on the LCD (see “Default Display” on page 28).
2. If the Stay Time Remaining / Return for Read display is set in the Quick Access displays (see “Quick Access” on page 29), press **Navigate** until Stay Time Remaining / Return for Read is displayed.
3. Otherwise,

**Navigate** or **Select** to *Menu* > **Select** > **Navigate** to *Remaining* > **Select** > **Navigate** to Stay Time Remaining / Return for Read.

**Figure 35.** Stay Time Remaining / Return for Read Display



## Dose Margin Used

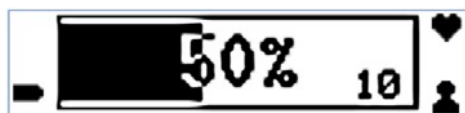
The Dose Margin Used display shows Dose received expressed as a proportion of the Dose Alarm Threshold. This is shown as a bar graph and percentage. Although the limit is evaluated for all the measurement quantities, it is the most limiting case that is displayed.

### ❖ To display Dose Margin Used

1. If the Dose Margin Used display is set to be the Default Display, this is displayed on the LCD (see “Default Display” on page 28).
2. If the Dose Margin Used display is set in the Quick Access displays (see “Quick Access” on page 29), press **Navigate** until Dose Margin Used is displayed.
3. Otherwise,

**Navigate** or **Select** to *Menu* > **Select** > **Navigate** to *Remaining* > **Select** > **Navigate** to Dose Margin Used

**Figure 36.** Dose Margin Used Display



## Static Data Displays

Static Data Displays show information that does not vary with time, or is not appropriate as a main EPD display.

Static displays cannot be configured to be the Default Display. Static displays cannot be pinned as the Current Display.

## Dose and Dose Rate Warning and Alarm Thresholds

The Dose and Dose Rate Alarm and Warning Thresholds display provides the following information:







- Measurement quantity
- Units
- Threshold type (Alarm **A** / Warning **i**)
- Numeric Threshold

See “Alarm/Warning Thresholds” on page 74 for further information.

### ❖ To display Dose/Dose Rate Warning/Alarm Thresholds

1. **Navigate** or **Select** to *Menu* > **Select** > **Navigate** to *measurement quantity* > **Select** > **Navigate** to Dose Alarm Threshold, Dose Rate Alarm Threshold, Dose Warning Threshold or Dose Rate Warning Threshold

**Figure 37.** Dose and Dose Rate Warning and Alarm Threshold Displays (examples)

 900.0 $\mu\text{Sv}$ Hp10	Hp10 Dose Alarm Threshold
 400.0 $\mu\text{Sv}$ Hp10	Hp10 Dose Warning Threshold
 15.00 mrem Hp07	Hp07 Dose Warning Threshold
 400.0 $\mu\text{Sv}$ Hp10N	Hp10N Dose Warning Threshold Neutron (-NG)
 20.0 $\mu\text{Sv/h}$ Hp10	Hp10 Dose Rate Alarm Threshold
 3.0 $\mu\text{Sv/h}$ Hp10	Hp10 Dose Rate Warning Threshold

**Issue State and Wearer Identification**

Wearer information can be written to the following fields:

- Wearer Name (see “[Issue State and Wearer ID](#)” on page 44)
- Wearer Name Graphic (see “[Graphic Wearer Name](#)” on page 44)
- Wearer Primary ID<sup>2</sup>, ID2 and ID3 (see “[Issue State and Wearer ID](#)” on page 44)

The Issue State for the EPD is displayed on each of the above displays as Unissued (⚡) or Issued (👤).

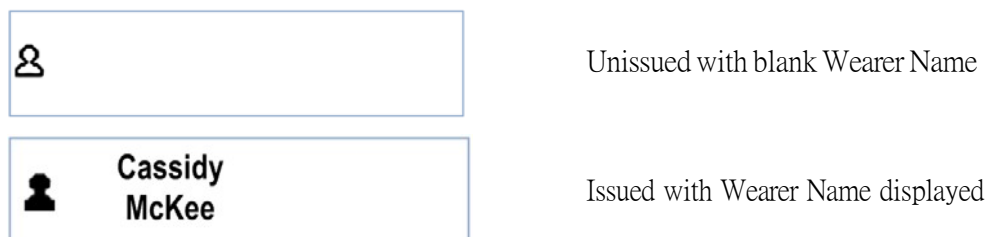
**Issue State and Wearer Name**

The Wearer Name display will display both the Issued Status and the Wearer Name (up to 32 alpha-numeric characters).

**❖ To display Wearer Name**

1. **Navigate** or **Select** to *Menu* > **Select** > **Navigate** to *Assignment* > **Select** > **Navigate** to Wearer Name.

<sup>2</sup> The minimum information to issue an EPD is Wearer Primary ID

**Figure 38.** Wearer Name Display

**Note:** It is possible to have an Unissued EPD with a Wearer Name programmed, a typical scenario would be a long term “issue” of the EPD outside of a nuclear power plant (NPP) style Dose management system.

## Graphic Wearer Name

The Graphic Wearer Name display is another display of Wearer Name intended to enable the display of non-Latin characters.

### ❖ To display Graphic Wearer Name

1. **Navigate** or **Select** to *Menu* > **Select** > **Navigate** to *Assignment* > **Select** > **Navigate** to Wearer Name.

**Figure 39.** Graphic Wearer Name Display

## Issue State and Wearer ID

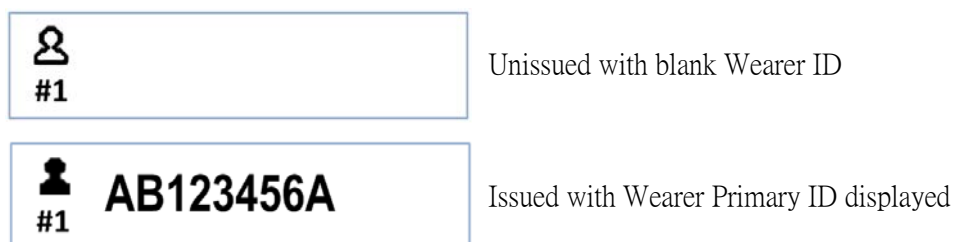
The Wearer Primary ID, 2 and 3 displays will display both the Issued Status and the Wearer ID (up to 32 alpha-numeric characters). This is normally considered to be a National Identity or Employee Number type of ID.

The layout will be similar to the Wearer Name display with the following differences:

- The field will not split on space or hyphen fields, it will just wrap at display extents.
- The Issued Icon will be supplemented with a ‘#1’, ‘#2’ or ‘#3’ symbol below the wearer icon. See “[EPD Issue and Return](#)” on [page 80](#) for more information.

### ❖ To display Issued State and Wearer ID

1. **Navigate** or **Select** to *Menu* > **Select** > **Navigate** to *Assignment* > **Select** > **Navigate** to Issue State and Wearer ID.

**Figure 40.** Issued State and Wearer ID Display**Task Name**

The Task Name displays the currently assigned Task Name (up to 32 alpha-numeric characters).

If the length of the task name contains spaces then an attempt will be made to break it into 2 lines on a word boundary. If this is not possible, the text will just wrap.

❖ **To display Task Name**

1. **Navigate** or **Select** to *Menu* > **Select** > **Navigate** to *Assignment* > **Select** > **Navigate** to Task Name.

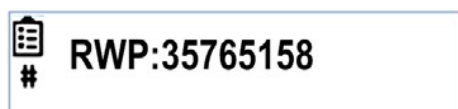
**Figure 41.** Task Name Display**Task ID**

The Task ID displays the currently assigned Task ID (up to 32 alpha-numeric characters). The layout will be similar to the Task Name display with the following differences:

- The Icon will be supplemented with a '#' symbol below the Task icon to indicate that it is the Task ID or number that is being displayed.

❖ **To display Task ID**

1. **Navigate** or **Select** to *Menu* > **Select** > **Navigate** to *Assignment* > **Select** > **Navigate** to Task ID.

**Figure 42.** Task ID Display

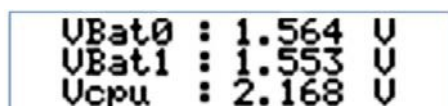
## Voltages

These are the Measured Voltages displaying the three key operating voltages of the EPD (see “Electrical Characteristics” on page 84 for further information).

### ❖ To display Voltages

1. Navigate or Select to *Menu* > *Select* > Navigate to *Diagnostics* > *Select* > Navigate to Voltages.

**Figure 43.** Voltages Display



## Counters

These are the Total counts accrued on each of the EPD's (up to) six counters (depending on the EPD Type). See “Counts” on page 77 for more information.

### ❖ To display Counters

1. **Navigate** or **Select** to *Menu* > *Select* > **Navigate** to *Diagnostics* > **Select** > **Navigate** to Counters.

**Figure 44.** Counters Display



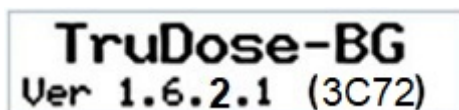
## EPD Firmware Version Information

This is the EPD Type and Version information. See “EPD Identity Data” on page 2 for further information.

### ❖ To display EPD Firmware Information

1. **Navigate** or **Select** to *Menu* > *Select* > **Navigate** to *Diagnostics* > **Select** > **Navigate** to Version.

**Figure 45.** EPD Version Display



Use **Select** to toggle through the following information:

- EPD Part Number (PN)
- EPD Serial Number (SN)
- EPD Mark Number (MK)
- PCB Part Number (PC PN)
- PCB Serial Number (PCB SN)
- FEM Serial Number (FEM SN)

Typ	Version	Checksumme
TruDose G	1.6.2.1	F4AB
TruDose BG	1.6.2.1	3C72
TruDose NG	1.6.2.1	AB47

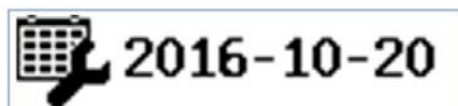
## Calibration Due Date

The Calibration Due Date displays the date in yyyy-mm-dd format. See “[Calibration Check](#)” on [page 57](#) for more information.

### ❖ To display Calibration Due Date

1. **Navigate** or **Select** to *Menu* > **Select** > **Navigate** to *Diagnostics* > **Select** > **Navigate** to Calibration Due Date.

**Figure 46.** Calibration Due Date Display



## Run Confidence Test

The EPD has a built-in Confidence Test facility. This runs automatically at instrument start up. This test can also be run at any time during operational use as a check that the EPD is functioning correctly. The Confidence Test can be stopped at any time by pressing the **Select** or **Navigate** button.

See “[Confidence Test](#)” on [page 101](#) for further information.

### ❖ To Run Confidence Test

1. **Navigate** or **Select** to *Menu* > **Select** > **Navigate** to *Diagnostics* > **Select** > **Navigate** to Run Confidence Test.

**Figure 47.** Run Confidence Test Display



2. Press **Select** to initiate the Confidence Test.

Since this is a significant action, confirmation is requested after pressing **Select** (see “[Action Confirmation](#)” on [page 49](#)).

## Alarm Test

The Alarm test allows the user to test and demonstrate the alarms in [Table 9](#). See “[Configurable Alarm Characteristics](#)” on [page 25](#) for more information.

### ❖ To test the Alarms

1. **Navigate** or **Select** to *Menu* > **Select** > **Navigate** to *Diagnostics* > **Select** > **Navigate** to Alarm Test

**Figure 48.** Alarm Test Display



2. Initiate the Alarm Test by first pressing **Select** (see “[Action Confirmation](#)” on [page 49](#)). Then toggle through the following alarms by pressing **Navigate**. Each Alarm will sound and vibrate for 10 seconds according to its settings. Pressing **Navigate** button within the 10 seconds moves

to the next alarm. The test will terminate if **Navigate** button is not pressed with 10 seconds

**Table 9.** Alarm Test Types

Alarm Type	Icon
Hp10 Dose Alarm	
Hp10 Dose Rate Alarm	
Hp10 Dose Warning	
Hp10 Dose Rate Warning	
Hp07 Dose Alarm	
Hp07 Dose Rate Alarm	
Hp07 Dosiswarnung	
Hp07 Dose Rate Warning	
Hp10 Dose Warning Neutron Component	
Hp10 Dose Rate Alarm Gamma Component	
Battery Low	
Return for Read	
Abuse Alarm	

TruDose NG only

TruDose NG only

## Functional Control Displays

Functional Control Displays allow the configuration or modification of EPD's operation. They have the following limitations:

- Cannot be configured to be the Default Display.
- Cannot be pinned as the Current Display.

Functional Control Displays require a confirmation of the action as follows:



## Action Confirmation

When confirmation of an action is requested, the following display is shown:



Returns to the previous menu display in the menu structure



Performs the action, see [Figure 28](#) on [page 35](#)

## EPD OFF

The EPD Off display, when selected, prompts the user to confirm the EPD Off request. If **Select** is pressed, then the EPD is transitioned to the Off state if it is currently turned On. Once the operation has been performed, the EPD reverts to its Off Mode display (see [“Off Mode Displays”](#) on [page 53](#)).

For further information regarding EPD Off, see [“During EPD Off Mode”](#) on [page 22](#).

For further information regarding EPD On, see [“During EPD On Mode”](#) on [page 23](#).

### ❖ To turn the EPD OFF

1. **Navigate** or **Select** to *Menu* > **Select** > **Navigate** to *Operations* > **Select** to EPD Off.

**Figure 49.** Turn EPD Off Display



2. Press **Select** to turn EPD Off.

Since this is a significant action, confirmation is requested after pressing **Select** (see [“Action Confirmation”](#) on [page 49](#)).

## EPD ON

The EPD On display is used to prompt the user to turn the EPD on.

If no button is pressed during the 2 second timeout, the display will revert to the Off Mode Display.

**Figure 50.** EPD On Display



### ❖ To turn the EPD ON

1. When EPD On Display is visible, the buttons have the following effect:



Turns the EPD On if it is currently turned off. If the EPD is already on, then no action is taken. Once the operation has been performed, the instrument shows the Default Display.

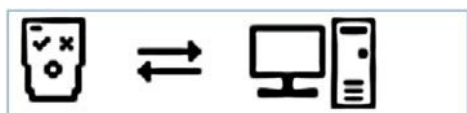


Returns to the Off Mode Display.

## Comms Active Prompt

If the EPD has been set as *Switch On from Button* disabled and the user attempts to turn an EPD On from the button, the Comms Active prompt is displayed. It is intended to convey to the user that the EPD needs to be turned On by placing it in a reader. Once this message is activated, the EPD will respond to an IR Communications Link for 15 minutes.

**Figure 51.** Comms Active Display



The display will revert to the Off Mode Display within a 2 second timeout, although it may still be read by a reader.

## Clear Dose

The Clear Dose display is used to clear the Doses and any active Dose Alarms. In Responder Mode EPDs, it also resets the trigger event.

### ❖ To Clear the Doses and Alarms

1. **Navigate** or **Select** to *Menu* > **Select** > **Navigate** to *Operations* > **Select** > **Navigate** to Clear Dose.

**Figure 52.** Clear Dose Display



2. Press **Select** to Clear Dose.

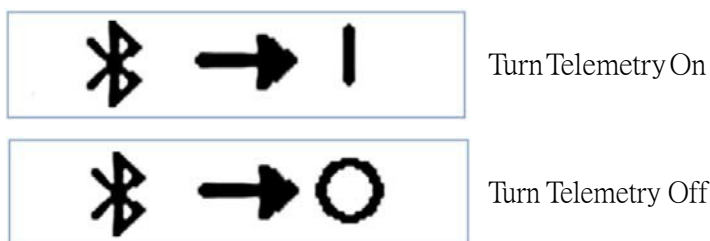
Since this is a significant action, confirmation is requested after pressing **Select** (see “[Action Confirmation](#)” on [page 49](#)).

## Telemetry On/Off

For further information regarding Telemetry, see “[Telemetry](#)” on [page 82](#).

### ❖ To Turn Telemetry On/Off

1. **Navigate** or **Select** to *Menu* > **Select** > **Navigate** to *Operations* > **Select** > **Navigate** to Telemetry On/Off.

**Figure 53.** Telemetry On/Off Display

1. Press **Select** to initiate.

Since this is a significant action, confirmation is requested after pressing **Select** (see “[Action Confirmation](#)” on [page 49](#)).

### Trigger Responder Dose Accumulation

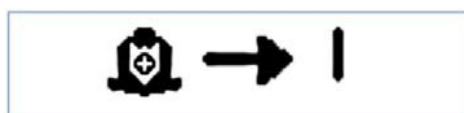
**Note:** This display is ONLY available on EPDs that have been Manufacturer enabled as Responder EPDs. For further information regarding Responder EPDs, see “[Responder Mode](#)” on [page 73](#).

When the Responder Dose is triggered using the buttons, Dose accumulation is Enabled so that the Responder EPD will accumulate Dose immediately and not wait for a Dose Rate alarm to occur.

#### ❖ To Start Accumulating Dose (Responder)

1. If the Trigger Responder Dose display is set in the Quick Access displays (see “[Quick Access](#)” on [page 29](#)), press **Navigate** until Trigger Responder Dose is displayed.
2. Otherwise,

**Navigate** or **Select** to *Menu* > **Select** > **Navigate** to *Operations* > **Select** > **Navigate** to Trigger Responder Dose.

**Figure 54.** Trigger Responder Dose Display

3. Press **Select** to initiate Start Accumulating Dose.

### Notification Displays

Notification Displays are transient displays that **alternate** with the Default Display when there is a condition that the user needs to be made aware of.

Notification Displays are not selectable by the user and cannot be navigated to using the Display Navigation Grid/Menu.

These displays can be categorised as follows:

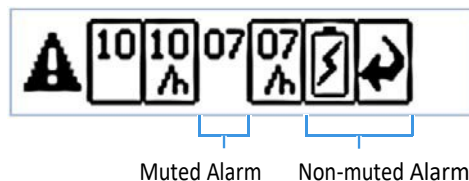
- “[Alarm Notification](#)” on [page 52](#)
- “[Warning Notification](#)” on [page 52](#)
- “[Overrange Alarm Notification](#)” on [page 53](#)

## Alarm Notification

The Alarm Notification is shown when one or more alarms are active. The display shows a prioritised list of up to 6 active alarms. Since there are more potential alarms than can be displayed on the display at any one time, the display will show alarm conditions that have not been acknowledged (muted) with higher priority than those that have been displayed.

The actual display comprises of an icon on the left of the display to identify that these are Alarms (rather than Warnings) which is then followed by a number of icons that denote each of the active alarms.

**Figure 55.** Alarm Notification Display



When fewer than the maximum number of 6 conditions are shown, the unused panels are not drawn and the active panels fill from the left.

In order to differentiate the Acknowledged Alarms from the Unacknowledged Alarms, the Acknowledged Alarms will have NO top and bottom border.

See “[Battery Alarm](#)” on [page 54](#) for further information regarding the Battery Alarms.

## Warning Notification

Warning Notification is using the same concepts as the Alarm Notification, using a Warning icon on the left of the display.

Where Alarms and Warnings for the same condition exist, e.g. Hp10 Dose Warning then Hp10 Dose Alarm have been triggered, the Warning is removed from the list as the condition has been promoted to an Alarm.

When cycling through the Alarms and Warning Notifications, only displays with active conditions are displayed.

**Figure 56.** Warning Notification Display



Example: TruDose G, - BG



TruDose NG

The Neutron Dose Meter TruDose NG incorporates separate warning and alarm thresholds for Neutron-, Gamma- and total dose and - dose rate. Measured quantity is always Hp10.

## Overrange Alarm Notification

The Overage Alarm Notification is shown when “Dose Overage” on [page 75](#) or “Dose Rate Overage” on [page 75](#) are triggered.

The Overage Alarm display alternates the numeric value 9999 between the alarm indication icons and the relevant Dose or Dose Rate Alarm.

**Figure 57.** Overage Alarm Notification



## Critical Failure Notification

The Critical Failure Notification is shown if any condition exists that may result in the indicated measurement being invalid or if the alarming operation of the EPD is compromised, e.g.

- Failure to load valid calibration data
- Detector Test failure
- Sounder Test failure

The display will be shown for as long as the fault condition persists. In the case of Detector Test failure, if this is transient, the fault display will be cancelled if subsequent tests pass, though the failure will be marked in the Quality Data associated with the current Issue Period and in the Event Log.

For faults that are not self clearing, e.g. Bad Calibration Data, the fault will remain until the fault flag is cleared. However, if the condition has not been resolved the fault will be raised again.

For more information regarding Fault Codes, see “EPD Faults and Recovery Actions” on [page 102](#).

**Figure 58.** Fault Code Display



## Off Mode Displays

In Off mode, the main Off display can be configured to be one of 6 different displays:

- “Off Display” on [page 54](#)
- “Calibration Due Date Display” on [page 54](#)
- “User Bitmap Display” on [page 54](#)
- “Manufacturer Logo Display” on [page 54](#)
- “Customer Logo Display” on [page 54](#)
- “EPD Version Display” on [page 54](#)

### Off Display

Figure 59. EPD Off Display



### Calibration Due Date Display

This Off Mode Calibration Due Date display will be the same as described in [“Calibration Due Date”](#) on [page 47](#).

### User Bitmap Display

The Off Mode User Bitmap display will display up to 40 characters of text rendered in the small 8x6 font.

### Manufacturer Logo Display

Figure 60. EPD Manufacturer Logo Off Display



### Customer Logo Display

Figure 61. Example of Customer Logo Off Display



### EPD Version Display

The Off Mode EPD Version display will be the same as described in [“EPD Firmware Version Information”](#) on [page 46](#).

## Battery Alarm

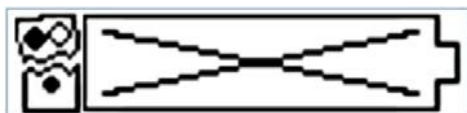
For further information regarding the battery, see [“The EPD Battery”](#) on [page 57](#).

The Battery Low Warning is added to the Warning Notification display, which will **alternate** with the Default Display (as described in [“Notification Displays”](#) on [page 51](#)).

Figure 62. Battery Low Warning Display



When the battery becomes critical, the EPD will attempt to use residual battery energy to operate the Sounder. However, the EPD is no longer able to accumulate Dose or activate any Dose Alarms. The Battery Critical indicator is displayed as follows:

**Figure 63.** Battery Critical Display

At this point, the battery must be changed immediately (see [“To Insert/Replace the EPD Battery”](#) on [page 14](#)).

## Maintenance for the EPD TruDose™

This section describes the maintenance that may be required for the EPD TruDose. Maintenance is limited to general cleaning, removing/replacing the EPD battery and removing/replacing the EPD clip assembly.

### Contents

- [“General Maintenance of the EPD”](#) on page 56
- [“Calibration Check”](#) on page 57
- [“The EPD Battery”](#) on page 57
- [“](#)
- [Cleaning the EPD”](#) on page 61

## General Maintenance of the EPD

General maintenance is confined to:

- Removing/replacing the EPD battery (see [“To Insert/Replace the EPD Battery”](#) on page 14)
- Removing/replacing the EPD clip assembly (see [“EPD Clip Assembly”](#) on page 10)
- Removing/replacing the Lanyard (see [“EPD Lanyard Assembly \(if required\)”](#) on page 12)
- Checking the functionality and calibration of the EPD (see [“Calibration Check”](#) on page 57)
- Keeping the unit clean (see [“](#)



- [Cleaning the EPD](#) on [page 61](#))

## Calibration Check

The EPD is factory calibrated by a highly sophisticated automatic system consisting of several radioactive sources. Calibration is performed during manufacture and is expected to remain unchanged throughout the life of the EPD - provided the EPD remains undamaged.

During factory calibration the various Detector Thresholds are set. The Threshold levels determine the minimum pulse amplitude that will be considered a “count”. The Detector Sensitivities are set to ensure that the Counting Channel data is combined in the correct fashion to give correct Dose readings.

Customers may wish to perform checks on radiation response using suitable test sources, or other irradiation facilities in accordance with appropriate regulations or company procedures.

EPD calibration may be checked using a suitable Irradiator, or by exposure to a known radiation field, in a manner approved by the appropriate regulating authority or local rules. It is recommended that calibration is checked annually. For further information, contact Thermo Fisher Scientific (see [“Contacting Us”](#) on [page xv](#)).

A change in EPD calibration response is usually indicative of a fault in the EPD and, due to the complexity of achieving calibration over the full energy range, it is recommended that any EPDs that fail calibration checks are returned to Thermo Fisher for repair, recalibration or replacement.

For further information, see [“Detectors and Processing”](#) on [page 64](#).

## EPDs supplied with Apply Gains locked

Thermo Fisher normal policy is to supply EPDs with Apply Gains locked to prevent their subsequent modification, other than by Thermo Fisher. However where expressly requested by customers in their purchase order, EPDs may be supplied with the Apply Gains control in the unlocked state. This is to enable such customers to modify the response of these EPDs. In such cases the customers attention is drawn to the following Disclaimer:

### **DISCLAIMER NOTICE REGARDING EPDs SUPPLIED WITH APPLY GAINS UNLOCKED**

See [“Apply Gains”](#) on [page 72](#) for further information.

EPDs have been calibrated using the factors as defined on the supplied Calibration Certificate. Where EPDs are supplied with Apply Gains NOT LOCKED, Thermo Fisher has no control over any subsequent adjustments made by the end user to these gains. Thermo Fisher can therefore not warrant the calibration of these EPDs once they have left the factory. As such, Thermo Fisher accepts no liability for the accuracy of the radiological response of these EPDs.

Where “Gaining” is used, this must be accounted for during calibration checking, either by adjusting the expected delivered Dose, or by temporarily disabling the Gaining effect using a suitable IR Communications Link such as EasyEPD3.

## The EPD Battery

The EPD can be powered by either a 3.6V Lithium Thionyl Chloride (LTC) battery or a standard 1.5V AA Alkaline type battery or a 1.2V NiMH rechargeable (see [“Replacement Batteries”](#) on [page 58](#)). A battery change is within the scope of any competent user. However, care must be taken when replacing the EPD battery (see [“To Insert/Replace the EPD Battery”](#) on [page 14](#)).

For details of Battery test, see [“Battery Load Test”](#) on [page 100](#).

## Replacement Batteries

Replacement batteries must be suitable for installation into the EPD. On no account must excessive force be used to insert the battery into its compartment. It is recommended that only batteries from major reputable manufacturers are used e.g.

Example batteries suitable for use with the EPD TruDose are as follows:

- Tadiran – Lithium-Thionyl Chloride 3.6v (TL-5903 or SL-760)
- SAFT – Lithium-Thionyl Chloride 3.6V (LS14500Ex)
- Duracell Industrial – Alkaline 1.5V (ID1500)
- Energizer Industrial – Alkaline 1.5V (EN91)
- Panasonic NiMH, 1.2V eneloop (HR-3UTGB)

AA batteries vary in dimensions, length, diameter and terminal detail. When selecting a battery manufacturer and type, avoid unknown manufacturers and those that don't comply to the IEC designation LR6. In all cases, the terminal detail must be the standard 'pip' design for the positive terminal, and a flat design for the negative terminal.

The user is also advised of the following:

- The overall length of the battery should be within the range 49.2 to 50.5mm (1.94 – 1.99in).
- The diameter of the battery should be in the range 13.5 to 14.7mm (0.53 – 0.57in).
- Battery life may differ from specification.
- Spent batteries must be disposed in accordance with local regulations.
- Never use a battery that shows any signs of damage.
- Battery low voltage thresholds are normally set automatically for LTC and Alkaline Batteries  
In case NiMH rechargeable is used: select that battery type via EasyEPD to avoid short time between battery warning and battery critical state.

For further information, contact Thermo Fisher Scientific (see [“Contacting Us”](#) on [page xv](#)).

### Characteristics of LTC Batteries

In the case of Lithium-Thionyl Chloride (Li/SOCl<sub>2</sub>) batteries, please ensure you select those that have a high pulse current capability (>150mA). While inserting fresh LTC batteries into instruments that are in switch off state, it is possible that the typical passivation of this battery type is not resolved. The instrument in that case may detect a low battery voltage at the next battery test and deactivate the instrument finally. This indicated by the crossed battery symbol. (Figure 63) The passivation may be removed by short circuiting the battery for a few seconds

with an Ampere meter. Short circuit current should rise to more than 150mA within a few seconds. If this value is not reached within a Minute the battery is exhausted and must not be used

If an alkaline battery is inserted into an instrument that was operated with a LTC battery before, be sure that the instrument is sufficiently long without battery (up to 10 Seconds) that a boot process is executed and the new battery type is detected.

If the Alkaline battery is inserted without rebooting the instrument, undervoltage will be detected at the next battery test cycle and the instrument will be switched off and the crossed battery symbol shown.

If the instrument is in OFF mode battery low status will not be shown on the display and the instrument will finally be switched off.

## EPD Battery Storage

Batteries that become expended should not be left in the EPD as they may leak. Batteries should also be removed from any EPD that is going to be left non-operational for any length of time to avoid the possibility that leakage may occur and damage the EPD. See [“Cleaning after a Battery Leakage”](#) on [page 61](#).

There is no definitive battery installation period. The best philosophy to adopt is: **if in doubt - remove the battery.**

## Lithium Thionyl Chloride Battery Warning

Lithium Thionyl Chloride (LTC) (Sulphurous Oxychloride,  $\text{SOCl}_2$ ) batteries are potentially dangerous and can be harmful. The following warnings are to be observed when inserting/replacing the EPD battery.



### WARNING REGARDING LITHIUM THIONYL CHLORIDE BATTERIES

1. Lithium Thionyl Chloride battery contents are potentially toxic, flammable and explosive.
2. Lithium Thionyl Chloride batteries should not be:
  - short circuited or charged under any circumstances.
  - used in excess of  $+70^{\circ}\text{C}$  and never exposed to temperatures in excess of  $+100^{\circ}\text{C}$ .
  - opened, punctured, crushed or tampered with.
3. Batteries in storage should be kept in an isolated, dry, well ventilated cool environment and kept out of direct sunlight. Storage temperatures should be below  $+30^{\circ}\text{C}$ .
4. Batteries are susceptible to fire and abuse. Some manufacturers provide batteries with a safety vent, which allows a controlled release of electrolyte if these conditions prevail. If the EPD has been damaged in a manner that could affect the battery, care must be exercised during battery replacement. The battery may have vented into the EPD case and caused the EPD to become pressurized.
5. Electrolyte leakage can normally be detected by the smell of sulphur dioxide and/or the presence of electrolyte solutes. If a leakage is suspected:
  - a. the battery should be removed from the EPD using protective clothing, gloves, and goggles.
  - b. the battery should be placed in a self-sealing polythene bag (or equivalent) and disposed of in the correct manner (see below).
  - c. Wash with copious amounts of water any areas that come into contact with the electrolyte, especially the skin. Seek medical advice if electrolyte comes in contact with the eyes.
6. Batteries must be disposed of in accordance with the manufacturer's recommendation and Local/National regulations.
7. If LTC batteries are to be transported by aircraft the batteries must be in their correct packaging.

## Cleaning the EPD

The EPD is a sealed unit and has protection against dust and low pressure jets of water from all directions. The unit will not withstand prolonged immersion under pressure. Cleaning should be carried out if the unit requires general cleaning, if the EPD battery has leaked or if the unit has come into contact with radioactive contamination.

### General Cleaning

The unit should be cleaned with warm soapy water. Use a neutral water-based detergent, other detergents may damage or attack the EPD's outer plastic coating. A small brush should be used to clean any crevices in the case moulding or clip. After cleaning dry the EPD with a soft cloth. During cleaning, water may enter the alarm sounder aperture. The sounder aperture is watertight, although water ingress may deaden the alarm. Any water should be shaken or blown out of the sounder aperture (with a very low pressure air supply) to restore the alarm noise level.

### Radiological Cleaning



**RADIOACTIVE CONTAMINATION** DURING OPERATIONAL USE THE EPD MAY BECOME EXPOSED TO RADIOACTIVE CONTAMINATION. THE EPD MUST BE SUBJECT TO ALL RELEVANT DECONTAMINATION PROCEDURES LAID DOWN BY THE RADIOLOGICAL PROTECTION AUTHORITY.

If radioactive deposits are present the unit should be decontaminated by carefully wiping it over using a disposable cloth or tissue dampened with a detergent solution and a small brush as described above, or alternatively by using a disposable 'sticky wipe rag'. The unit should afterwards be checked with a sensitive radiation monitor to ensure satisfactory decontamination has been achieved.

### Cleaning after a Battery Leakage

Any leakage of the EPD battery must be treated with extreme caution. In most instances battery leakage will be confined within the EPD battery compartment. Minor leakage (light smearing) may be removed with a proprietary cotton bud moistened with a water-based detergent. However, if doubt exists as to the extent of the leakage the EPD should be considered as unusable and the manufacturer contacted for advice.

### Periodic Cleaning

The EPD should be cleaned by wiping it over periodically with a cloth lightly dampened with a solution of water and up to 5% of a neutral water-based detergent.



## Technical Description

This section describes the technical features of the EPD TruDose.

### Contents

- “Brief Functional Description” on page 63
- “Detectors and Processing” on page 64
- “On and Off Operating Modes” on page 71
- “Available EPD Configurations” on page 72
- “EPD TruDose Communications via IR Link” on page 74

## Brief Functional Description

The Thermo Fisher Scientific EPD TruDose family are highly sophisticated monitors sensitive to ionizing radiation in the following energy range:

- **Gamma, X-rays:** 16 keV to 10 MeV (all types: -G, -BG, -NG)

In addition the EPD TruDose-BG is sensitive to beta radiation (energetic electrons) in the following energy range:

- **Beta radiation:** 200 keV to 1.5 MeV (mean energy)

The Beta detector will respond to low energy Beta radiations ( $^{147}\text{Pm}$ ) at very close distance.

- **Neutron radiation:** thermic to 20 MeV (TruDose NG only)

A full list of radiological characteristics and specifications can be found in [Appendix C, “Radiological Specifications”](#) of this Handbook.

Radiation signal from the silicon diode detectors is combined to give the following Dose equivalents (as defined by ICRU Document 47):

- Hp(10) personal Dose equivalent at a depth of 10 mm of tissue (TD-NG: also Neutron)
- Hp(0.07) personal Dose equivalent at a depth of 0.07 mm of tissue

The EPD calculates both the accumulated Dose and Dose Rate for each measurement quantity. These, and other data, are stored in an internal store (EEPROM) within the EPD. Buttons on the EPD case allows the user to retrieve this data from store, select a range of displays, acknowledge alarms and perform user control functions. Data is displayed to the user on a LCD display on the top of the EPD (see [“LCD Display for the EPD TruDose™”](#) on [page 32](#)). To minimise the loss of data from battery or other failure, data is saved regularly to the EEPROM (see [“EEPROM storage of detected radiation”](#) on [page 4](#)).

Data can be written to and read from the EPD via an integral IR Communications link. The Thermo supplied *EasyEPD3* program reads and writes data to the EPD via the IR Communications link and displays the data in a PC window (see [“EPD TruDose Communications via IR Link”](#) on [page 74](#)).

Thermo also produces a range of Access Control Systems for use with the EPD.

Dose is accumulated separately in the EPD in two stores: *Dose* and *Total Dose* (see [“Dose and Total Dose”](#) on [page 65](#)). This allows Dose to be recorded over differing periods, for example the *Dose* store may be used for each job or task performed (and reset after each), whilst the *Total Dose* records the total or aggregate Dose from all the jobs or tasks performed. Note that audible, visual and/or physical alarms are given if either the accumulated Dose or Dose Rates exceed programmable threshold levels. Dose alarms are raised against the *Dose* store only but can also be adjusted downwards if the workers Total Dose status is more limiting.

## Detectors and Processing

Depending upon EPD Type (see [“EPD Types”](#) on [page 1](#)), each EPD contains silicon diode detectors for Hard Gamma (HG), Soft Gamma (SG) and Beta (FB) detection.

TruDose NG additionally: Albedo Neutron (AN) and fast Neutron (FN). These feed a chain of dedicated amplifiers, discriminators and counter circuits providing a set of counting channels for processing by the EPD firmware.

The outputs from each Counting Channel are processed to calculate and display measured Dose and Dose Rates.

## Detector Sensitivities

Detector Sensitivities convert the counts accumulated on the Counting Channels into personal Dose equivalents. These constants are:

**Table 10. Detector Sensitivities**

Sensitivities	TruDose G	TruDose BG	TruDose NG	Detector Threshold
Hg1Sens10G	✓	✓	✓	HG_1
Hg2Sens10G	✓	✓		HG_2
Sg1Sens10G	✓	✓	✓	SG_1
Sg3Sens10G	✓	✓	✓	SG_3
Hg1Sens07G	✓	✓		HG_1
Hg2Sens07G	✓	✓		HG_2
Sg1Sens07G	✓	✓		SG_1
Sg3Sens07G	✓	✓		SG_3
Fb1Sens07B		✓		FB_1



Sg2Sens07B		✓		SG_2
An1Sens10N			✓	AN
Fn1Sens10N			✓	FN_1
Fn2Sens10N			✓	FN_2

Where EPDs are provided with Apply Gains enabled (see [“Apply Gains”](#) on [page 72](#)), the sensitivities may be adjusted within the defined percentages from the manufacturers original calibration. These ‘Gain’ adjustments are made using software facilities available via Thermo Fisher Scientific but should only be considered in consultation with Thermo.

## Detector Thresholds

See [“Counts”](#) on [page 65](#) for more information regarding the Detector thresholds.

A change in EPD response is usually indicative of a fault in the EPD and, due to the complexity of achieving calibration over the full energy range, it is recommended that any EPDs that fail calibration checks are returned to the manufacturer for repair or replacement.

Detector Thresholds discriminate between radiation pulses received by the EPDs detectors. The EPD has up to six Counting Channels:

**Table 11.** EPD Internal Counters

Detector Thresholds	EPD TruDose BG	EPD TruDose G	EPD TruDose NG
1	HG_1	HG_1	HG_1
2	HG_2	HG_2	FN_1
3	SG_1	SG_1	SG_1
4	SG_2 <sup>b</sup>		AN
5	SG_3	SG_3	SG_3
6	FB		FN_2

<sup>b</sup> SG\_2 is used to compensate for the Gamma response of the Beta measurement Threshold FB and is equivalent to the BC channel of the Mk1 and Mk2 Beta/Gamma Dosemeters.

These record the pulses output by each of the radiation detectors.

The EPD calculates the measurement quantity Doses by weighted summing of the counts received on the six Detector Thresholds.

## Counts

Counts (unlike Doses) are never cleared but are “baselined” to create a copy of the current values in the EPD.

Thereafter, it is possible to read and difference the current Counts and the Baselined Counts to determine the Counts accumulation.

Actual Counts are displayed in the EPD, depending on the EPD Type (see [“EPD Types”](#) on

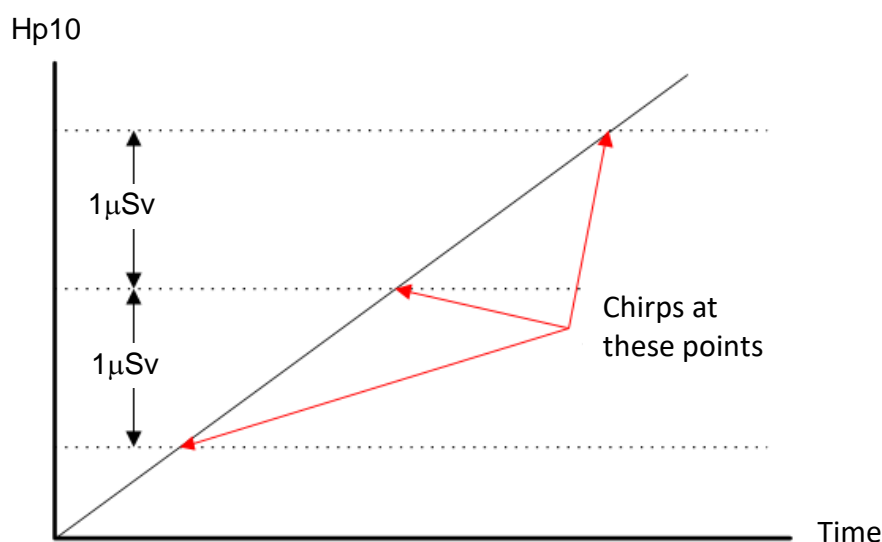
[page 1](#)) - see “[Counters](#)” on [page 46](#). Baseline Counts can only be read via the IR Communications link.

## Chirp Function

The EPD can be configured to give a warning chirp at each increment in the Hp10 Dose. This increment can be set between  $0.01 \mu\text{Sv}$  and  $100 \mu\text{Sv}$ .

An example of the Chirp function, set to increments of  $1 \mu\text{Sv}$  is shown in “Chirp Example” on page 67. With a Chirp Sensitivity of  $1 \mu\text{Sv}/\text{chirp}$  and a Dose Rate of  $10\text{mSv}/\text{h}$ , the Chirp Alarm will average 2.8 chirps every second.

**Figure 64.** Chirp Example



## Dose and Total Dose

The EPD displays measurement quantity Dose (depending on the “EPD Types” on page 1). *Dose* is regarded as a short-term record of Dose received, usually associated with the issue of an EPD. It is this value that is compared with Dose Alarm Thresholds and an alarm raised if the value exceeds the thresholds. *Total Dose* is a store providing a long-term record of Dose accumulated by the EPD. The LCD display will auto-range between  $0.1 \mu\text{Sv}$  to  $10 \text{Sv}$  (resolution up to four digits) - see “Display Formats (Dose and Dose Rate)” on page 91.

Accumulated Dose is written to secure non-volatile memory (EEPROM) at least every 15 minutes and if removing the battery. Battery removing events however are detected and a count of Power Cycles provided as Quality Data associated with the accumulated Dose (see “Quality Data” on page 78).

## Triggered Dose

For certain applications where the EPD is continuously switched on but accumulation of background is not desired the start of dose accumulation can be triggered by exceeding a dose rate threshold or by pressing a key.

“Responder Mode” on [page 73](#) for more information.

## Dose Rate

This is the current Dose Rate as calculated by the EPD. It may be viewed on the LCD display or read via the IR Communications link. Dose Rates are calculated using an averaging algorithm to reduce statistical variations. This results in increased averaging time constants at low Dose Rates. In case of changing dose rates the averaging time constant is reduced to ensure a fast response of the dose rate indication. The algorithm achieves low statistical fluctuation and optimal fast response time. The Dose Rate displays on the LCD can be limited to 2 significant digits (see “User Interface” on [page 82](#)).

For TruDose G and TruDose BG the Hp(10) Dose Rate alarms can be set to values as low as 1uSv/h without fail alarms at background level. For TruDose NG the Hp(10)-neutron and Hp(10)-total Dose Rate alarms can be set to values as low as 10uSv/h without fail alarms at background level.

## Peak Dose Rate and Time

The highest Dose Rate value calculated by the EPD since this value was last cleared is termed the Peak Dose Rate. The Peak Dose Rates and the time at which these Peak Dose Rate occurred are recorded and can be displayed on the LCD or read over the IR Communications link.

**Note:** Peak Dose Rate times are stored to 1 second resolution.

## Dose and Dose Rate Alarm Thresholds

Dose and Dose Rate Alarms are checked and updated every second. Alarms can be adjusted or inhibited via the IR Communications link.

Dose<sup>1</sup> and Dose Rate Alarms are calculated against a preset alarm threshold set in the EPD. When the Dose and/or Dose Rate equals or exceeds the Dose and/or Dose Rate Threshold, the alarm will activate.

Latched and Unlatched Alarms are normally cleared over the IR Communications link at the start of an issue period:

For each measurement quantity:

Dose Alarm and Warnings	<p>When the <math>\text{Dose} \geq \text{Dose Warning Alarm Threshold}</math>, the Dose Warning Alarm will activate.</p> <p>The Dose Warning Alarm can be inhibited by setting the value higher than the Dose Alarm.</p> <p>When the <math>\text{Dose} \geq \text{Dose Alarm Threshold}</math>, the Dose Alarm will activate.</p>
Dose Overrange Alarm	<p>If a Dose exceeds 10.0Sv, the Dose Overrange Alarm will activate.</p> <p>The Overrange Alarm can be muted (if enabled). The Overrange Alarm will not recur after muting should Overrange conditions reoccur (e.g. in the case of a second Dose Overrange Alarm), until the latched condition has been cleared over the IR Communications link. However the display will continue to indicate the overrange.</p> <p>See <a href="#">“Overrange Alarm Notification”</a> on <a href="#">page 53</a>.</p>
Dose Rate Alarm and Warnings	<p>When the <math>\text{Dose Rate} \geq \text{Dose Rate Warning Alarm Threshold}</math>, the EPD will operate the Dose Rate Warning Alarm.</p> <p>The Dose Rate Warning Alarm can be inhibited by setting set the value higher than the Dose Rate Alarm.</p> <p>When the <math>\text{Dose Rate} \geq \text{Dose Rate Alarm Threshold}</math>, the EPD will operate the Dose Rate Alarm.</p>

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<sup>1</sup> Note that it is Dose and not Total Dose that is compared with the threshold.

**Dose Rate Overage Alarm** If Dose Rate exceeds 10 Sv/h, the Overage Alarm will activate.

The Dose Rate Overage Alarm condition is latched and the LED will continue to flash even after a temporary Dose Rate Overage condition has cleared. The Overage conditions are recorded in the EPD EEPROM and must be cleared over the IR Communications link before the display will stop flashing.

The Dose Rate Overage Alarm can be Overranged (if enabled). The Overage Alarm will not recur after muting should Overage conditions re-occur (e.g. in the case of a second Dose Rate Overage Alarm), until the latched condition has been cleared over the IR Communications link. However the LED will continue to flash.

See [“Overrange Alarm Notification”](#) on [page 53](#).

**Dose Rate Off %** The Dose Rate Off field is a percentage of the Dose Rate Alarm/Warning values.

Warnings and Overage are latched and have to be manually cleared in [“Measurement Alarm Status”](#) on [page 78](#).

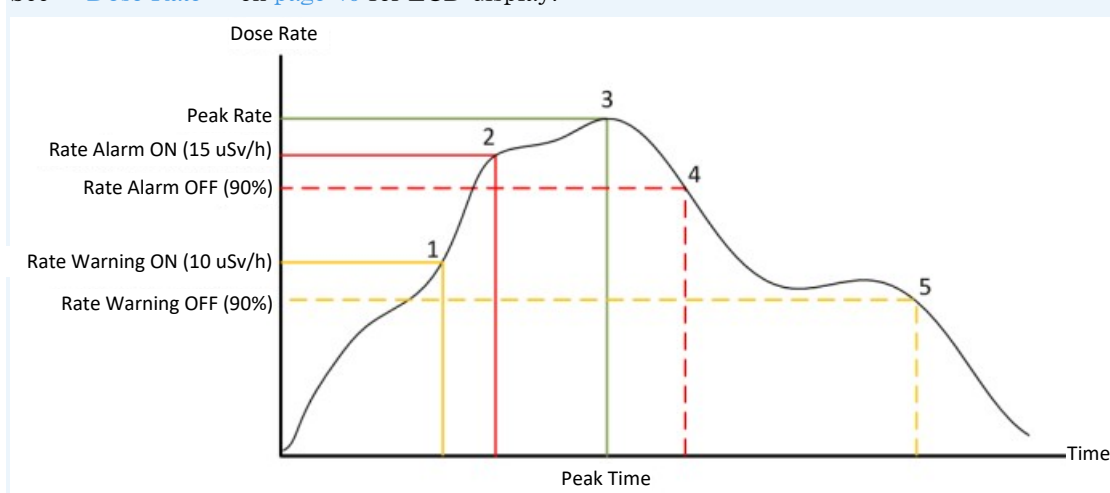
**Note:** In the example below, as the Dose Rate rises above the Dose Rate Warning Threshold (point 1), the Dose Rate Warning Alarm will activate.

As the Dose Rate increases above the Dose Rate Alarm Threshold (point 2), the Dose Rate Alarm will activate.

The Peak Dose Rate is recorded (point 3). The Dose Rate Alarm will self-cancel when the Dose Rate falls below the Dose Rate Off % (point 4).

The Dose Rate Warning Alarm will self-cancel when the Dose Rate falls below the Dose Rate Off % (point 5).

See [“Dose Rate”](#) on [page 40](#) for LCD display.



Alarm thresholds are set via the IR Communications link, to any value in the following ranges:

Alarm Threshold	per Measurement quantity
Dose	0.1 $\mu$ Sv to 10 Sv
Dose Warning	0.1 $\mu$ Sv to 10 Sv
Dose Rate	0.1 $\mu$ Sv/h to 10 Sv/h
Dose Rate Warning	0.1 $\mu$ Sv/h to 10 Sv/h
Dose Rate Off % <sup>a</sup>	0 to 100%

<sup>a</sup> Note this is a percentage of the Rate Alarm/Warning values.

Values below 1  $\mu$  Sv or 1  $\mu$  Sv/h can be set but are below the specified effective range of measurement

## On and Off Operating Modes

The EPD has an ON/OFF and Power Saving facility:

- On Mode - the detectors are turned ON and the EPD is measuring radiation.
- Off Mode - the detectors are turned OFF and the EPD is not measuring radiation (this is intended for short-term storage, e.g. overnight). The LCD displays the default Off setting (see “[Off Mode Displays](#)” on [page 53](#)).
- Power Saving Mode - the LCD is blank.

### When the EPD is in OFF Mode:

- The detectors are turned off (intended for short or medium term storage with battery left in situ e.g. overnight).
- Battery drain is reduced to approximately 20% of the drain when the EPD is in ON mode (i.e. fully operational).
- The EPD is not measuring Dose though some background operations such as periodic Battery Test button will still take place.
- The normal On Mode User Interface will be unavailable.
- Also, the ability to wake the EPD via the IR Communications link can be configured to be always On or not (see “[Comms Active Prompt](#)” on [page 50](#)).
- In Off Mode, the user can select the information displayed (see “[Off Mode Displays](#)” on [page 53](#)).

## Available EPD Configurations

Certain features of an EPD may be supplied as a standard configuration (locked at the Thermo Fisher factory into a particular configuration), in accordance with customer preferences. This protects the customer from any risk of un-authorized and undesirable settings being applied.

Thermo shall create particular EPD Part Numbers for these required configurations. For further information, contact Thermo Fisher Scientific (see “[Contacting Us](#)” on [page xv](#)).

**This is not a definitive list and are examples only**

**Table 12.** Operational Configurations<sup>a</sup>

Configuration	Settings	Description
Apply Gains See “ <a href="#">Apply Gains</a> ” on <a href="#">page 72</a>	Adjustable	The customer is able to define, apply and remove Sensitivity Gains from the Thermo Factory Calibration.
	Not Adjustable	EPD is locked on Thermo Factory Calibration.
Clear On Switch On See “ <a href="#">Clear On Switch On</a> ” on <a href="#">page 73</a>	Available	The customer can set or clear “Clear On Switch On” functionality in an EPD.
	Not Available	EPD is locked as No “Clear On Switch On” . EPD would be cleared by a IR Communications link.
Covert Mode See “ <a href="#">Covert Mode</a> ” on <a href="#">page 73</a>	Available	EPD can be placed in and out of “Covert Mode” from UI or IR Communications Link.
	Not Available	EPD is locked as No Covert Mode.
Responder Mode See “ <a href="#">Responder Mode</a> ” on <a href="#">page 73</a>	Enabled	EPD is locked as Responder Mode.
	Not Enabled	EPD is locked as non-Responder Mode.
Pulsed Mode See “ <a href="#">Pulsed Mode</a> ” on <a href="#">page 74</a>	Enabled	EPD is locked as Pulse Mode.
	Not Enabled	EPD is locked as non-Pulse Mode.
Reduced Overrange (Pulsed field)	Available	EPD can be placed in and out of “Reduced Overrange” from UI or IR Communications Link.
	Not Available	EPD is locked as No Reduced Overrange.

<sup>a</sup> For each item, there are typically four options: Writable/Not Writable and Factory settings

## Apply Gains

*Previously known as ‘Calibration Parameters Locked/Unlocked’*

EPDs configured as “Apply Gains” allow the user to adjust the ‘gains’ of the EPD calibration within specified % limits from the original manufacturer’s calibration. Otherwise, the Gains are ignored and the EPD operates on the original calibration settings.



## Clear On Switch On

*Previously known as 'ClearOnOn'*

EPDs configured as Clear On Switch On are generally intended for emergency use. When the EPD is switched from Off to On mode (from either button or via the IR Communications link), the following will occur:

- The Dose will be cleared (Total Dose is not cleared)
- The Quality Data factors will be cleared
- The Peak Dose Rates and Times are cleared
- EPD faults are cleared (they will recur if the fault is still present)
- EPD Dose Rate alarms are cleared.
- EPD Counters are base-lined.
- The Return for Read time is set to current date/time plus the number of hours (1 to 31) in the EPD Return for Read Offset. (0 = no change in Return for Read time).

**Note:** Removing the battery and replacing it does NOT change the EPD mode from Off to ON, the mode is unchanged and the Clear ON Switch ON does not operate.

## Covert Mode

In Covert Mode, the alarm indicators (Audible, Visual and Vibe) are disabled, as well as the following:

- Backlight is disabled
- Chirp is disabled
- Alarm Indication on the LCD shall continue
- The underlying Alarm Configuration shall be preserved Covert Mode applies to all conditions, including Power Cycle.

## Responder Mode

*Previously known as 'DoseOnAlarm'*

When the EPD is configured as a Responder, the EPD continues to accumulate Counts, Total Dose, and to calculate Dose Rates as normal. However, Dose is not accumulated until:

- A Dose Rate Alarm (or Warning) is activated
- From the EPD button - see [“Trigger Responder Dose Accumulation”](#) on [page 51](#)

The Dose continues to accumulate (even after the Dose Rate alarm has ceased). It will continue to accumulate until the EPD Dose is cleared. At this point you should also clear the Latched alarms in [“EPD Status”](#) on [page 78](#). The Responder Mode avoids integration of background for EPD continuously switched on.

- The EPD provides an integrated dose measurement of the Dose received whilst the EPD is in a triggered state.
- The date and time that an EPD was triggered is recorded and is available over the IR Communications link.
- The condition is cleared when a Dose Clear event occurs (via the IR Communications link or EPD UI).

## Pulsed Mode

There are two pulsed Modes available:

- Industrial: enables the recognition of pulsed industrial X-ray sources in direct beam. (ns pulses)
- Medical: enables correct dose response for medical X-ray fields for pulse durations down to 2ms and Dose Rates up to 10Sv/h. (Without medical mode activated an under response in dose rate fields of 1Sv/h to 10Sv/h pulsed radiation will occur)

## Deep Sleep

If the EPD is configured as Deep Sleep Mode, once the EPD is switched OFF, it will enter Power Saving Mode (i.e. Display is blank) after a default timeout.

The EPD can only be “woken” when one of the buttons is pressed.

See “[During EPD Off Mode](#)” on [page 22](#) for further information.

## EPD TruDose Communications via IR Link

**Note: For a full description of the EPD settable functions and displays, please refer to the EasyEPD3 Handbook (see “[Related Documentation](#)” on [page xiv](#)). EasyEPD3 is a Thermo Fisher PC-based software product for maintaining, configuring and reading EPDs.**

The EPD TruDose Models have a rich feature set which can be configured to the users’ requirements over the IR Communications link using suitable software such as EasyEPD3. These configuration options are explained in this section.

Note that some parameters are accessible only by the Manufacturer and must be determined before delivery takes place ( “[Available EPD Configurations](#)” on [page 72](#)).

This section describes how to communicate with the EPD and the features available over the IR Communications Link:

- “[Communicating with the EPD](#)” on [page 75](#)
- “[EPD Configuration via the IR Communications Link](#)” on [page 77](#)
  - “[Dose and Dose Rate](#)” on [page 77](#)
  - “[Counts](#)” on [page 77](#)
  - “[Alarm/Warning Thresholds](#)” on [page 74](#)
  - “[Quality Data](#)” on [page 78](#)

- “EPD Status” on page 78
- “EPD Issue and Return” on page 80
- “Calibration” on page 81
- “Dose Profile” on page 81
- “Event History” on page 81
- “EPD Identity” on page 82
- “EPD Configuration” on page 82
- “User Interface” on page 82
- “Telemetry” on page 82
- “Access Levels” on page 82
- “Batch Write” on page 82

## Communicating with the EPD

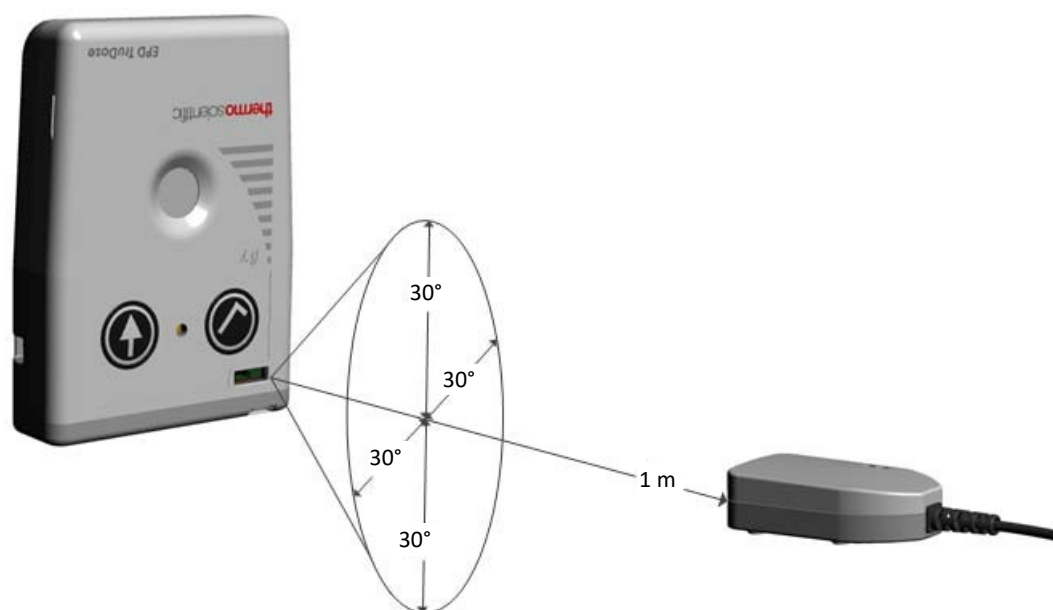
The EPD electronically stores Dose and Dose Rate data, together with other information that is required to control and configure the EPD. Communication with the EPD is necessary in order to read data from and to write data to store so that EPD parameters, operational control and general functionality can be pre-configured.

The EPD can also be configured to be used in a simple application without the use of IR Communications Link. In this case, Dose data may be recorded manually from the LCD Display and the EPD configured to Clear Dose automatically when switched On.

During the read/write process the EPD can be configured for any (or all) of the display selections shown in [Figure 28](#) on [page 35](#) to be made available to the user, as required. Only limited functions can be configured via the EPD button.

On the front of the EPD there is an Infrared Interface for reading and writing data. Communication with the EPD is usually via a Desktop Reader Dongle or Desktop Reader, connected to a host PC. The Infrared communication range for Desktop Reader Dongle is up to 1m, over an angle of  $\pm 30^\circ$  from the normal to the front of the EPD (see [Figure 65](#)).

**Figure 65.** EPD Communications range for Desktop Reader Dongle



The Desktop Reader has a nest where the EPD can be placed for reading (see [Figure 66](#)).

**Figure 66.** Desktop Reader showing TruDose EPD in nest



## EPD Configuration via the IR Communications Link

Communication via the EPD IR Communications link will allow access to the following EPD functions and displays:

**EPD CONFIGURATION RESTRICTIONS:** Access to these configuration parameters is restricted according to the Access Level Commands set for the EPD. See [“Access Levels”](#) on [page 82](#) for further information.

### Dose and Dose Rate

The IR Communications link allows the Reader software and applications to read the following: For each measurement quantity: For further information, see:

- Dose<sup>a</sup> [“Dose and Total Dose”](#) on [page 65](#)
- Dose Rate [“Dose Rate”](#) on [page 68](#)
- Total Dose [“Dose and Total Dose”](#) on [page 65](#)
- Triggered Dose (if enabled) [“Triggered Dose”](#) on [page 68](#)
- Peak Dose Rate and Time [“Peak Dose Rate and Time”](#) on [page 68](#)

<sup>a</sup> See [“EPD Configuration”](#) on [page 82](#) for information regarding the Dose Write Enable function.

### Counts

The user can view the actual and baseline Counts for the EPD. It is also possible to baseline the Counts and Timestamp.

See [“Counts”](#) on [page 65](#) for further information.

### Clear Buttons

The following Clear buttons are available:

- Clear Dose
- Clear Peaks
- Clear Total
- Clear All

Note that these buttons are disabled when the EPD is issued.

### Alarm/Warning Thresholds

The IR Communications link allows the user to view and set (with the appropriate Access Level) the Dose and Dose Rate Alarm/Warning Thresholds for the EPD. See [“Dose and Dose Rate Alarm Thresholds”](#) on [page 69](#) for further information.

## Quality Data

The user is able to view the Dose Quality Data of the EPD via the IR Communications link. The faults and events are counted and recorded in association with the measured Dose. They are zeroed when the Dose is zeroed and are subsequently read with the Dose. Non-zero Quality Data factors imply that there may be an error in the Dose reading due to the way the EPD has been used, rather than due to a fault within the unit. For example, the battery hatch may have been opened or a passivated battery fitted, causing a Power Cycle and potentially lost Dose.

There are eight Quality Data flags set within the EPD:

- Abuse Warning
- Detector Test Fault
- Counter Overrange <sup>a</sup>
- Dose Overrange
- CRC Failure
- Dose Rate Overrange
- Number of Knocks
- Power Cycles (previously known as ‘Resets’)

<sup>a</sup> This option is not currently implemented

Quality Data can only be read and cleared via the IR Communications link. They are normally cleared with the Dose and detector counters at the start of an Issue period, e.g. by Access Control or Issue/Return software. In ‘Dose of record’ systems, EPD Dose, detector counters and quality factors are all read together and stored on the system database to allow later integrity checking of the Dose recorded.

## EPD Status

The EPD retains information regarding its status. EPD status can only be read via the IR Communications link. Status information provided is:

- “Measurement Alarm Status” on [page 78](#).
- “General Alarm Status” on [page 80](#).
- “Fault Status” on [page 80](#).
- “Operating Status” on [page 79](#).

## Measurement Alarm Status

The EPD retains a record defining which of the following alarms has occurred. The Dose and Dose Rate Alarms are normally cleared by system software at the start of an issue period. Latched Alarms can be cleared using the “Clear Latched button” on [page 80](#).

For each measurement quantity:

- Dose Alarm
- Dose Warning
- Dose Overrange

- Dose Rate Alarm
- Dose Rate Warning
- Dose Rate Overrange
- Latched Rate Alarm
- Latched Rate Warning
- Latched Rate Overrange

## Operating Status

The EPD retains a record of its Operating Status as follows:

- EPD is On/Off
- EPD Issued
- Issue Count
- Detector Test Passed
- Detector Test Requested
- Calibration Due
- Calibration in Progress
- Telemetry On
- Telemetry Connected
- Gain Adjustable
- Gain Adjusted
- Responder Enabled
- Responder Triggered
- Reduce Rate Overrange
- Dose Write Enabled
- Clear On Switch On Enabled
- Alkaline Battery Fitted
- Golden
- Pulsed Mode
- Covert Mode Enabled
- Protected Session
- Deep Sleep Mode Enabled

## **General Alarm Status**

The EPD retains a record defining which of the following General Alarms has occurred. The record is normally cleared by system software at the start of an issue period:

- Stay Time Exceeded
- Return For Read
- Telemetry Alert
- Low Battery
- Abuse Alarm

## **Fault Status**

The EPD retains a record of any Faults that have occurred. Faults can be cleared using the “Clear Faults button” on [page 77](#).

- Bad Threshold
- Bad Sensitivities
- EEPROM Failure
- EPD Faulty
- Not Initialized
- Not Calibrated
- Early Comms Termination
- Sounder Failure
- Detector Test Failed
- Error Logged
- Time Invalid
- Fault Code - see “EPD Faults” on [page 102](#)

## **Clear Buttons**

The following Clear buttons are available:

- Clear Latched button
- Clear Faults button

## **EPD Issue and Return**

Allows the user to Issue and Return an EPD. The EPD retains details relating to the Issued status of the EPD, as follows:

- Wearer Name and up to three IDs
- Task Name and ID
- EPD Issue State - whether the EPD is Issued or not
- Issue Count <sup>a</sup> - the total number of times that the EPD has been issued



- Issue Date <sup>a</sup> - the date/time that the EPD was issued
- Calibration Due Date - the due date for the next annual Calibration check
- Detector State - whether the EPD Detectors are ON or OFF

<sup>a</sup> Can only be read through the IR Communications link

## Calibration

The Calibration Details window allows the user to view the Calibration general information, Sensitivities (including Gain Factors if enabled) and Thresholds for the EPD.

See “[Detectors and Processing](#)” on page 64 for further information.

## Dose Profile

The EPD stores integrated Dose by time period to a resolution of 0.1  $\mu$  Sv in non-volatile store, so that a profile of the Dose over time can be recreated. The interval between stores is setup via the IR Communications link.

Measurement quantity Dose information is stored as a Dose profile, the minimum interval between entries in the Dose profile is adjustable between 2 seconds to 35 hours, in 2 second intervals. The store holds up to 1792 records for transitions up to 1000  $\mu$  Sv or less.

Dose Points are timestamped using the EPD Real Time Clock (RTC). By keeping the RTC synchronized (see “[EPD Configuration](#)” on page 82), the user is assured that the time base of an extracted profile is correct, even after a period with the battery removed. Whenever the battery is removed/replaced, it is desirable to re-synchronize the EPD RTC using the IR Communications link.

**Note:** A Dose profile interval of zero seconds turns off the Dose profile function.

Dose Profile can only be read via the IR Communications link. Dose profile may be synchronized to a particular time in the future, e.g. hourly logging on the hour.

Additional profile records are made if the Dose has changed since the last Dose profile record when the EPD is De-Issued or the EPD is turned from On to Off Mode.

See “[Memory Characteristics](#)” on page 88 for further information.

## Event History

The EPD logs up to 255 Events, together with a time stamp. The store comprises a circular ‘buffer’, the latest event over-writing the oldest.

Dose Points are timestamped using the EPD Real Time Clock (RTC). By keeping the RTC synchronized (see “[EPD Configuration](#)” on page 82), the user is assured that the time base of an extracted event is correct, even after a period with the battery removed. Whenever the battery is removed/replaced, it is desirable to re-synchronize the EPD RTC using the IR Communications link.

The Event History store is accessible when the EPD is interrogated over the IR Communications link. See “[Memory Characteristics](#)” on page 88 for further information.

## EPD Identity

EPD Identity allows the user to view the identification of the EPD and its relevant sub-assemblies. See [“EPD Identity Data”](#) on [page 2](#) for further information.

## EPD Configuration

EPD Configuration allows the user to configure the EPD Display as follows:

- EPD Clock Settings allows the user to check and synchronize the EPD clock.
- Dose Profile Configuration allows the user to setup the configuration for the Dose Profile
- General Configuration allows the user to set the EPD as the following
  - Apply Gains (see [“Apply Gains”](#) on [page 72](#))
  - Dose Write Enabled
  - Clear On Switch On (see [“Clear On Switch On”](#) on [page 73](#))

## User Interface

User Interface allows the user to configure the EPD User Interface Display as follows:

- EPD Display Options allows the user to setup:
  - Dose Display (see [“Dose and Dose Rate Display Characteristics”](#) on [page 90](#))
  - Backlight options (see [“Backlight Display Characteristics”](#) on [page 90](#))
- LCD Display Configuration allows the user to setup the EPD Display, including Off Mode settings
- Alarm Configuration allows the user to view and setup the EPD Alarms and Locks (see [“Alarms Characteristics”](#) on [page 87](#))

## Telemetry

Allows the user to enable, disable and configure Telemetry.

## Access Levels

Allows the user to set the access permissions for the EPD between different User Levels.

## Batch Write

The Batch Write utility allows the configuration of a single or multiple EPDs.



## Physical Characteristics of the EPD

This section describes the general physical and functional characteristics of the EPD TruDose as follow.

### Contents

- “Electrical Characteristics” on page 84
- “Mechanical Characteristics” on page 86
- “Real Time Clock Characteristics” on page 86
- “Alarms Characteristics” on page 87
- “Communications Characteristics” on page 88
- “Memory Characteristics” on page 88
- “System Integration Facilities” on page 89
- “Backlight Display Characteristics” on page 90
- “Dose and Dose Rate Display Characteristics” on page 90
- “Display Formats (Dose and Dose Rate)” on page 91

## Electrical Characteristics

**Table 13.** Electrical Characteristics

Feature	Characteristics
Type	Single AA battery, 1.5V Alkaline OR 3.6V Lithium Thionyl Chloride. See “Lithium Thionyl Chloride Battery Warning” on page 60.
Access Hatch Dimensions	Diameter: 13.9 to 14.6 mm. Length: 49.0 to 51.0 mm.
Access	Two M2 (or security) screws. Environmental and EMC seal. See “To Insert/Replace the EPD Battery” on page 14.

Feature	Characteristics
Typical Life	<p>Normal continuous operation <sup>a</sup>:</p> <p>1.5V Alkaline Battery (2800mAh):</p> <ul style="list-style-type: none"> <li>• 50 days continuous.</li> <li>• 110 days, assuming 8/24 h shifts, Off after shift, Off display On</li> <li>• 150 days assuming 8/24 h shift, Off after shift, Off display Off</li> </ul> <p>3.6V Lithium Battery (2200mAh):</p> <ul style="list-style-type: none"> <li>• 4.5 months continuous.</li> <li>• 9 months, assuming 8/24 h shift, Off after shift, Off display On</li> <li>• 13 months, assuming 8/24 h shift, Off after shift, Off display Off</li> </ul> <p>1.2V NiMH Rechargeable (2000mAh):</p> <ul style="list-style-type: none"> <li>• 20 days continuous.</li> <li>• 50 days, assuming 8/24 h shift, Off after shift, Off display On</li> <li>• 70 days, assuming 8/24 h shift, Off after shift, Off display Off</li> </ul> <p>The battery life is taken as the interval between new battery being fitted and first indication of the battery low warning.</p>
Battery Test	<p>Configurable Time Interval for both On and Off Mode between 1 minute and 24 hours (default 15 minutes)</p> <p>Warning raised with 8 hours + remaining.</p> <p>See <a href="#">“Battery Load Test”</a> on <a href="#">page 100</a>.</p>
On/Off control	Via IR Communications link and button, when enabled.

<sup>a</sup> Normal Continuous Operation is defined as:

- Alarm is on for less than 15 minutes total per month.
- Communications frequency on average no more than twice per day and less than 30 seconds communications time on average per day

## Mechanical Characteristics

**Table 14.** Mechanical Characteristics

Feature	Characteristics
Weight	106g, including 3.6V Lithium battery and rear fitted clip.
Dimension	85.5 x 63 x 21mm, excluding clip.
Construction	Tough plastic case (Cycloy C1200HF), Windows (Polycarbonate). Sealed case construction and battery hatch.
Case Colors	Grey/White color scheme as standard.
Clip	High grip, easily removable. An alternative front-mounted clip is available.
Lanyard	Permanent lanyard fixing points on casing and clip. Emergency release mechanism.
Buttons	Sealed and recessed to prevent inadvertent operation. Tactile, with “click” operator feedback.
Teledosimetry	Internal Bluetooth Low Energy (BLE) Radio Module.

## Real Time Clock Characteristics

**Table 15.** Real Time Clock Characteristics

Feature	Characteristics
Real Time Clock	EPD has real time clock for accurate time tagging of Dose Profile and recorded events.
Battery Removal	RTC continues with battery removed for at least 10 hours.
IR Communications link	Synchronization of EPD clock.

## Alarms Characteristics

These Display Characteristics can be changed using the IR Communications Link.

**Table 16** Alarm Characteristics

Feature	Characteristics
Alarm Types	<p>Sounder, LED and Vibe alarms for:</p> <ul style="list-style-type: none"> <li>· EPD Failure</li> <li>· Overrange (Dose or Dose Rate) <sup>a</sup></li> <li>· Dose Alarms (per measurement quantity)</li> <li>· Abuse Alarm</li> <li>· Dose Rate Alarms (per measurement quantity) <sup>a</sup></li> <li>· Dose Warning (per measurement quantity)</li> <li>· Dose Rate Warning (per measurement quantity) <sup>a</sup></li> <li>· Battery Low</li> <li>· Stay Time Exceeded/Return for Read</li> </ul> <p>Alarms are configurable via the IR Communications link.</p>
Sounder Output (Alarms)	<ul style="list-style-type: none"> <li>· Loud 4 kHz (<math>97 \pm 2</math> dBA) at 20cm</li> <li>· Loud 2kHz (<math>78 \pm 2</math> dBA) at 20cm</li> <li>· Quiet 4 kHz (<math>84 \pm 2</math> dBA) at 20cm</li> <li>· Quiet 2 kHz (<math>66 \pm 2</math> dBA) at 20cm</li> </ul>
Configuration (per alarm)	<ul style="list-style-type: none"> <li>· Tone: 2 or 4 KHz</li> <li>· Volume: Loud/Quiet/Off</li> <li>· LEDs: High/Low/Off</li> <li>· Vibe: Enabled/Disabled</li> <li>· Duration: 0-3600 seconds, 5 second resolution OR continuous</li> </ul>
Tones	High/low tones, loud/quiet volume in seven combinations of continuous or fast/slow intermittent.
Dose Chirp	<p>‘Chirp’ rate, proportional to Hp10 Dose Rate.</p> <p>Sensitivity selectable from <math>0.01 \mu\text{Sv/chirp}</math> to <math>100 \mu\text{Sv/chirp}</math> via IR Communications Link.</p>

<sup>a</sup> Dose Rate and Overrange alarm status is latched for subsequent system analysis

## Communications Characteristics

**Table 17.** Communications Characteristics

Feature	Characteristics
Type	IR communication to front of unit, range up to 1m. Use with Thermo Fisher supplied IR Reader (e.g. Desktop Reader), Reader DLL application software as required (EasyEPD3, Access Controls/w etc.).  See <a href="#">“Communicating with the EPD”</a> on <a href="#">page 75</a> for further information.
Issue/Return	Issue and Return times of typically <2 seconds (excluding user input times).

## Memory Characteristics

**Table 18.** Memory Characteristics

Feature	Characteristics
Memory Retention	10-year data retention
Dose Profile History	Settable interval from 2 to 65535 seconds (i.e. 18 hours, 12 minutes and 15 seconds). Stores transition of measurement quantity at a resolution of 0.1 $\mu$ Sv. Store for up to 1792 records for transitions between 0.1 $\mu$ Sv and 60,000 $\mu$ Sv.
Event History Log	Log of at least 255 Events.
Peak Dose Rates	Peak Dose Rates with time of occurrence.
Storage Times	1 second resolution.
Alarm Flags	Various alarm and fault flags. See <a href="#">“Configurable Alarm Characteristics”</a> on <a href="#">page 25</a>
Stay Time Remaining <sup>a</sup>	Count-down timer configurable up to 24 hours (1 minute resolution).
Return for Read <sup>a</sup>	Enabled/Disabled Count-down timer alarming when date/time is reached.

<sup>a</sup> Note that these features use the same Alarm



## System Integration Facilities

**Table 18.** System Integration Facilities

Feature	Characteristics
Messaging Interface	A powerful and efficient messaging interface allows fast and secure data transfer and speedy issue and return times. Data is protected by 16 bit crc. Issue and Return times take circa 1 second. Returns take longer if extensive dose profile data is being extracted.
EPD Identity	Every EPD has a unique serial number provided on the case label (numeric and bar-coded) and duplicated in internal memory. The latter is accessible over the communications link. See <a href="#">“EPD Identity Data”</a> on <a href="#">page 2</a> .
Mark Number	Every EPD is manufactured to a defined Mark Number which is detailed on the case label and duplicated in internal memory. The latter is accessible over the communications link. See <a href="#">“EPD Identity Data”</a> on <a href="#">page 2</a> .
Wearer ID x 3	32 character numeric Wearer ID (Wearer Primary ID is essential, others may be used but are not essential).
Wearer Name	32 character Wearer Name (may be used but is not essential).
Task ID	32 character numeric Task ID (may be used but is not essential).
Task Name	32 character Task Name (may be used but is not essential).
Controls	<p>Various controls are possible over the IR Communications link to (for example):</p> <ul style="list-style-type: none"> <li>· Configure displays</li> <li>· Sounder operation</li> <li>· Detector and Self Test</li> <li>· EPD dose and detector counts</li> <li>· Set Alarm Thresholds and Alarm characteristics</li> <li>· Turn the EPD On or Off</li> <li>· Enable and disable controls via the button</li> <li>· Adjust the Dose Profile settings.</li> </ul> <p>See <a href="#">“EPD TruDose Communications via IR Link”</a> on <a href="#">page 74</a>.</p>

**Table 19.** System Integration Facilities

Feature	Characteristics
Teledosimetry	Dose values, Status information and wearer ID can be transmitted in a configurable interval.
Operational issues	<p>During critical data writes (e.g. issues and returns) the EPD can be triggered to alarm if the worker removes the EPD from the IR media before the communication completes.</p> <p>System software can activate the sounder and alarm LED to communicate normal completion (short beep and flash) or failure (long sound and alarm LED).</p>

## Backlight Display Characteristics

These Display Characteristics can be changed using the IR Communications Link.

**Table 20.** Backlight Display Characteristics

Feature	Characteristics
Enabled/Disable	Default = activated
On Period	<p>Default = 10 seconds</p> <p>Range 2 to 30 seconds</p>

## Dose and Dose Rate Display Characteristics

These Display Characteristics can be changed using the IR Communications Link.

**Table 21.** Dose and Dose Rate Display Characteristics

Feature	Characteristics
Display Units	Sv or rem
Dose Display	0.1 $\mu$ Sv to 99.99 Sv, resolution $\geq 0.1$ $\mu$ Sv, up to four decimal places
Dose Rate Display	0.1 $\mu$ Sv/h to 99.9 Sv/h, resolution $\geq 0.1$ $\mu$ Sv/h, up to three decimal places
Resolution	<ul style="list-style-type: none"> <li><math>\mu</math> Sv (can be disabled)</li> <li>mSv</li> <li>mrem</li> </ul>
Decimal Places	<ul style="list-style-type: none"> <li>Limit to 2 decimal places for dose rate</li> </ul> <p>See <a href="#">“Display Formats (Dose and Dose Rate)”</a> on page 91.</p>

## Display Formats (Dose and Dose Rate)

The following table shows the display on the LCD for Dose and Dose Rate values:

**Table 22.** Standard Dose Display Formats

Basic Value ( $\mu\text{Sv}$ )	Standard Display Dose = Sv			Standard Display Dose = rem			Standard Display $\mu\text{Sv}$ Disabled			
0	0.	0	$\mu\text{Sv}$	0.	0	mrem	0.	0	0	mSv
0.1	0.	1	$\mu\text{Sv}$	0.	0	1 mrem	0.	0	0	mSv
0.9	0.	9	$\mu\text{Sv}$	0.	0	9 mrem	0.	0	0	mSv
1.0	1.	0	$\mu\text{Sv}$	0.	1	0 mrem	0.	0	0	1 mSv
9.9	9.	9	$\mu\text{Sv}$	0.	9	9 mrem	0.	0	0	9 mSv
10.0	1	0.	0 $\mu\text{Sv}$	1.	0	0 mrem	0.	0	1	0 mSv
99.9	9	9.	9 $\mu\text{Sv}$	9.	9	9 mrem	0.	0	9	9 mSv
100.0	1	0	0. 0 $\mu\text{Sv}$	1	0.	0 0 mrem	0.	1	0	0 mSv
999.9	9	9	9. 9 $\mu\text{Sv}$	9	9.	9 9 mrem	0.	9	9	9 mSv
1,000	1.	0	0 0 mSv	1	0	0. 0 mrem	1.	0	0	0 mSv
9,999	9.	9	9 9 mSv	9	9	9. 9 mrem	9.	9	9	9 mSv
10,000	1	0.	0 0 mSv	1.	0	0 0 rem	1	0.	0	0 mSv
99,994	9	9.	9 9 mSv	9.	9	9 9 rem	9	9.	9	9 mSv
100,000	1	0	0. 0 mSv	1	0.	0 0 rem	1	0	0.	0 mSv
999,949	9	9	9. 9 mSv	9	9.	9 9 rem	9	9	9.	9 mSv
1,000,000	1.	0	0 0 Sv	1	0	0. 0 rem	1.	0	0	0 Sv
9,999,499	9.	9	9 9 Sv	9	9	9. 9 rem	9.	9	9	9 Sv
10,000,000	1	0.	0 0 Sv	1	0	0 0 rem	1	0.	0	0 Sv
99,994,999	9	9.	9 9 Sv	9	9	9 9 rem	9	9.	9	9 Sv

**Table 23.** Standard Dose Display (Limited to 2 decimal places) Formats

Basic Value ( $\mu\text{Sv}$ )	Standard Display Dose = Sv Limited to 2dp			Standard Display Dose = rem Limited to 2dp			Standard Display $\mu\text{Sv}$ Disabled Limited to 2dp			
0	0.	0	$\mu\text{Sv}$	0.	0	0 mrem	0.	0	0	mSv
0.1	0.	1	$\mu\text{Sv}$	0.	0	1 mrem	0.	0	0	mSv
0.9	0.	9	$\mu\text{Sv}$	0.	0	9 mrem	0.	0	0	mSv
1.0	1.	0	$\mu\text{Sv}$	0.	1	0 mrem	0.	0	0	mSv
9.9	9.	9	$\mu\text{Sv}$	0.	9	9 mrem	0.	0	0	mSv
10.0	1	0	$\mu\text{Sv}$	1.	0	mrem	0.	0	1	mSv
99.4	9	9	$\mu\text{Sv}$	9.	9	mrem	0.	0	9	mSv
100.0	1	0	0 $\mu\text{Sv}$	1	0	mrem	0.	1	0	mSv
994.9	9	9	0 $\mu\text{Sv}$	9	9	mrem	0.	9	9	mSv
1,000	1.	0	mSv	1	0	0 mrem	1.	0		mSv
9,949	9.	9	mSv	9	9	0 mrem	9.	9		mSv
10,000	1	0	mSv	1.	0	rem	1	0		mSv
99,499	9	9	mSv	9.	9	rem	9	9		mSv

Basic Value ( $\mu\text{Sv}$ )	Standard Display Dose = Sv Limited to 2dp				Standard Display Dose = rem Limited to 2dp				Standard Display $\mu\text{Sv}$ Disabled Limited to 2dp			
100,000	1	0	0	mSv	1	0		rem	1	0	0	mSv
994,999	9	9	0	mSv	9	9		rem	9	9	0	mSv
1,000,000	1.	0		Sv	1	0	0	rem	1.	0		Sv
9,949,999	9.	9		Sv	9	9	0	rem	9.	9		Sv
10,000,000	1	0		Sv	1	0	0 0	rem	1	0		Sv
99,499,999	9	9		Sv	9	9	0 0	rem	9	9		Sv

**Table 24.** Standard Dose Rate Display Formats

Basic Value ( $\mu\text{Sv}$ )	Standard Display Dose = Sv/h				Standard Display Dose = rem/h				Standard Display Dose = Sv/h Limited to 2dp			
0		0.	0	$\mu\text{Sv/h}$		0.	0	0 mrem/h	0.	0		mSv/h
0.1		0.	1	$\mu\text{Sv/h}$		0.	0	1 mrem/h	0.	0		mSv/h
0.9		0.	9	$\mu\text{Sv/h}$		0.	0	9 mrem/h	0.	0		mSv/h
1.0		1.	0	$\mu\text{Sv/h}$		0.	1	0 mrem/h	0.	0	0	1 mSv/h
9.9		9.	9	$\mu\text{Sv/h}$		0.	9	9 mrem/h	0.	0	0	9 mSv/h
10.0	1	0.	0	$\mu\text{Sv/h}$	1.	0	0 mrem/h		0.	0	1	0 mSv/h
99.9	9	9.	9	$\mu\text{Sv/h}$	9.	9	mrem/h		0.	0	9	9 mSv/h
100.0	1	0	0	$\mu\text{Sv/h}$	1	0.	0 mrem/h		0.	1	0	0 mSv/h
999.4	9	9	9	$\mu\text{Sv/h}$	9	9.	0 mrem/h		0.	9	9	9 mSv/h
1,000	1.	0	0	mSv/h	1	0	0 mrem/h		1.	0	0	mSv/h
9,994	9.	9	9	mSv/h	9	9	0 mrem/h		9.	9	9	mSv/h
10,000	1	0.	0	mSv/h	1.	0	rem/h		1	0.	0	mSv/h
99,949	9	9.	9	mSv/h	9.	9	rem/h		9	9.	9	mSv/h
100,000	1	0	0	mSv/h	1	0.	0 rem/h		1	0	0	mSv/h
999,499	9	9	9	mSv/h	9	9.	0 rem/h		9	9	9	mSv/h
1,000,000	1.	0	0	Sv/h	1	0	0 rem/h		1.	0	0	Sv/h
9,994,999	9.	9	9	Sv/h	9	9	9 rem/h		9.	9		Sv/h
10,000,000	1	0.	0	Sv/h	1	0	0 0 rem/h		1	0.	0	Sv/h
99,949,999	9	9.	9	Sv/h	9	9	9 0 rem/h		9	9.	9	Sv/h

**Table 25.** Dose Rate Display (Limited to 2 decimal places) Formats

Basic Value ( $\mu$ Sv)	Dose Rate = Sv/h Limited to 2dp			Dose Rate = rem/h Limited to 2dp			$\mu$ Sv Disabled Limited to 2dp		
0	0.	0	$\mu$ Sv/h	0.	0	mrem/h	0.	0	mSv/h
0.1	0.	1	$\mu$ Sv/h	0.	0	1 mrem/h	0.	0	mSv/h
0.9	0.	9	$\mu$ Sv/h	0.	0	9 mrem/h	0.	0	mSv/h
1.0	1.	0	$\mu$ Sv/h	0.	1	0 mrem/h	0.	0	0 mSv/h
9.9	9.	9	$\mu$ Sv/h	0.	9	9 mrem/h	0.	0	0 mSv/h
10.0	1	0	$\mu$ Sv/h	1.	0	mrem/h	0.	0	1 mSv/h
99.4	9	9	$\mu$ Sv/h	9.	9	mrem/h	0.	0	9 mSv/h
100.0	1	0	0 $\mu$ Sv/h	1	0	mrem/h	0.	1	0 mSv/h
994.9	9	9	0 $\mu$ Sv/h	9	9	mrem/h	0.	9	9 mSv/h
1,000	1.	0	mSv/h	1	0	0 mrem/h	1.	0	mSv/h
9,949	9.	9	mSv/h	9	9	0 mrem/h	9.	9	mSv/h
10,000	1	0	mSv/h	1.	0	rem/h	1	0	mSv/h
99,499	9	9	mSv/h	9.	9	rem/h	9	9	mSv/h
100,000	1	0	0 mSv/h	1	0	rem/h	1	0	0 mSv/h
994,999	9	9	0 mSv/h	9	9	rem/h	9	9	0 mSv/h
1,000,000	1.	0	Sv/h	1	0	0 rem/h	1.	0	Sv/h
9,949,999	9.	9	Sv/h	9	9	0 rem/h	9.	9	Sv/h
10,000,000	1	0	Sv/h	1	0	0 0 rem/h	1	0	Sv/h
99,499,999	9	9	Sv/h	9	9	0 0 rem/h	9	9	Sv/h

## Radiological Specifications

This section provides the Radiological Specifications for the EPD TruDose (compliant with IEC 61526 Ed.3), as follow:

**Table 25A.** Table of Radiological Performance (IEC61526)

Feature	Hp10	Hp07
Radiation	X, $\gamma$ rays, (-G, -BG, -NG): 16 keV to 10 MeV  Neutron (-NG) thermic to 20MeV	X, $\gamma$ rays, (-G, -BG): 20 keV to 10 MeV  $\beta$ rays, (-BG): 200 keV to 1.5 MeV (Averaged Beta Energy)
Dose Range	1 $\mu$ Sv to $\geq 10$ Sv G, BG, NG $\gamma$  100 $\mu$ Sv to $\geq 10$ Sv NG, n	50 $\mu$ Sv to $\geq 10$ Sv - G X, $\gamma$ rays 50 $\mu$ Sv to $\geq 10$ Sv - BG $\beta$ rays 500 $\mu$ Sv to $\geq 10$ Sv - BG X, $\gamma$ rays
Dose Overrange	$\geq 10$ Sv	$\geq 10$ Sv
Dose Rate Range	1 $\mu$ Sv/h to $\geq 10$ Sv/h G, BG 1 $\mu$ Sv/h bis $\geq 2$ Sv/h - NG, $\gamma$ 0,5 mSv/h bis $\geq 10$ Sv/h - NG, n	10 $\mu$ Sv/h to $\geq 10$ Sv/h -G X, $\gamma$ 1 mSv/h to $\geq 10$ Sv/h -BG X, $\gamma$ , $\beta$
Dose Rate Range for Dose	0.05 $\mu$ Sv/h to $\geq 10$ Sv/h G, BG 0.05 $\mu$ Sv/h to $\geq 2$ Sv/h NG $\gamma$ 1 $\mu$ Sv/h to $\geq 10$ Sv/h - NG,n	1 $\mu$ Sv/h to $\geq 10$ Sv/h G, BG X $\gamma$ , $\beta$
Dose Rate Overrange	10 Sv/h to $\geq 50$ Sv/h true Dose Rate	10 Sv/h to $\geq 50$ Sv/h true Dose Rate
On-axis Energy Response	Photon (Ref. $^{137}\text{Cs}$ ): $\pm 10\%$ , 16keV to 1.5 MeV $-15\%$ , $+50\%$ , 1,5 MeV to 10 MeV	Photon (Ref. $^{137}\text{Cs}$ ): $\pm 29\%$ , 20 keV to 1,5 MeV $-29\%$ , $+50\%$ , 1,5 MeV to 10MeV  Beta (Ref. $^{90}\text{Sr}$ ): $\pm 30\%$ , 200 keV to 1.5 MeV detection of $^{147}\text{Pm}$ starts with Preabsorption less than 15 mg/cm <sup>2</sup>
Combined Energy and Angular Response	Ref. $^{137}\text{Cs}$ : $-29\%$ to $+67\%$ , 16 keV to 10 MeV (0° to 60°)	Ref. $^{137}\text{Cs}$ : $-40\%$ to $+40\%$ , 20 keV to 25 keV $-29\%$ to $67\%$ ,

Feature	Hp10	Hp07
		25 keV to 10 MeV (0° to 60°)
		Ref. <sup>90</sup> Sr: -29% to +67%, 200keV to 1,5 MeV (0° to 45°)
Accuracy	Ref. <sup>137</sup> Cs: ±10%	Ref. <sup>137</sup> Cs: ±10%
		Ref. <sup>90</sup> Sr: ±20%

**Table 25B.** Radiological Performance for pulsed Radiation (-G and - BG only)**Medical X-Ray, Pulse Width > 2 ms**

Feature	Range	Response
Maximum Dose Rate in Pulse	0,05 µSv/h to 55 Sv/h	80 % ... 120 %
Maximum Dose in Pulse	no Limit	same as continuous Radiation
Indication of Dose Rate Overrange	up to 1000 Sv/h	equivalent to > 10 Sv

**Table 25C.** Radiological Performance for pulsed Radiation**Industrial X-Ray, Pulse Width < 1 µs**

Feature	Range	Response
Maximum Dose Rate in Pulse	no Limit	same as continuous Radiation
Maximum Dose in Pulse	0 µSv to 0,01 µSv	> 80 %
Indication of Dose Rate Overrange	> 0,01 µSv/Pulse	0,02 µSv/Pulse max.

## Environmental Specifications

This section provides the Environmental Specifications of the EPD TruDose, as follow:

**Table 26.** Environmental Specifications

Feature	Range	Notes
Temperature Range	-20°C to +50°C	May be subject to some degradation of display quality and battery life, at low temperature.
Temperature Range (Storage)	-25°C to +70°C	Without battery fitted.
Humidity	20% to 90% RH, non-condensing	
Shock	Dropped from 1.5 meters onto concrete surface (meets IEC 61526).	
IP Rating	EPD TruDose-BG meets IP-65. EPD TruDose-G meets IP-67.	
EMI-EMC (including static discharge)	Meets IEC 61526	
Radiation Life	Minimum of 50 Sv	





## In Built Integrity Checks

The following Built In Integrity Checks are available in the EPD TruDose.

### Contents

- “Measurement Initialization Process” on page 98
- “Detector Test” on page 99
- “Battery Load Test” on page 100
- “
- Confidence Test” on page 101

## Measurement Initialization Process

The Measurement function initializes whenever:

- The EPD powers up into the ON state.
- On the transition OFF to ON from the button (where enabled).
- On the transition OFF to ON via the IR Communications link. The Initialization Process comprises the following:
  1. Acquiring data required for the performance of the measurement, integration and alarming functions, from non-volatile store e.g. calibration data, existing stored data, alarm configuration including all thresholds.
  2. Turning necessary hardware on, meeting any order or timing requirements (FPGA, bias voltage generator).
  3. Writing Detector Thresholds to the hardware (see “Detector Thresholds” on page 65).
  4. Initiating *appropriate* hardware tests (e.g. “Detector Test” on page 99, “Battery Load Test” on page 100).
  5. Checking for possible fault conditions, e.g.
    - Computing the Firmware Checksum and indicating it on the Display.
    - Corruption of any acquired data, e.g. CRC16 checks.
    - Fail result from hardware test (e.g. Flash LED detector test).
  6. Initiating a Dose Clear operation where the EPD is configured for Clear On Switch On (see “Clear On Switch On” on page 73).

7. Indicating success or failure as appropriate on the EPD Display and via the Reader interface for Reader initiated Turn-on.
8. Recording the Turn On event / result in the Event Log.
9. Enabling the ON Mode UI on successful initialization.
10. Updating all relevant status data (Mode and fault status).
11. Starting a new *Stay Time Remaining*, where this feature is enabled and for a duration that has previously be configured in the EPD by the responsible person (see “[Stay Time Remaining / Return for Read](#)” on [page 41](#)).

## Dose and Dose Rate Computation

The following activities shall commence on successful Measurement Initialization Process above:

1. Measurement of Dose and Dose Rate as appropriate to the Type of the EPD (see “[EPD Types](#)” on [page 1](#)).
2. Dose Integration, Peak Dose Rate calculation and Dose profile collection in accordance with the EPDType(see “[EPD Typs](#)” on [page 1](#)).
3. Detector test (see “[Detector Test](#)” on [page 99](#)).
4. Warning and alarm processing.

**Note:** When an EPD is in the “not factory calibrated state” , it shall continue to process input counts into doses, in order to permit calibration to take place.

## Detector Test

The EPD can be configured to automatically run a Detector Test at regular intervals between 1 and 24 hours (at 1 minute intervals).

The Detector Test is performed automatically whenever:

- The EPD powers up into the ON state
- On the transition OFF to ON from the button (where enabled)
- At a user-configurable Self Test interval

The Detector test sequence is as follows. This test sequence is automatic:

1. The hardware counters that have been configured as appropriate to the EPD Type and Mk number are tested by pulsing the Flash LEDs and reading the counters, before and after (see “[EPD Types](#)” on [page 1](#)).
2. Counts that can be attributed to the Detector Test are not included in counts accumulation or processed into Dose or Dose Rate contributions.

## Detector Test Failure

If the Detector Test is unsuccessful, the following will result:

- a. A Fault Code is shown on the EPD display (see [“Critical Failure Notification”](#) on [page 53](#)) and over the IR Communications link.
- b. Faults shall be recorded in the Event History.
- c. The EPD wearer shall be alerted to newly detected EPD faults by means of a fault alarm.
- d. Fault alarms shall be re-issued at Start-up and on EPD OFF to ON transitions, if the fault recurs.

## Battery Load Test

The Battery Load Test is performed automatically whenever:

- When the EPD is On, at the Battery Test (On Mode) Interval
- When the EPD is Off, at the Battery Test (Off Mode) Interval
- The following information is available over the IR Communications link:
  - The type of battery currently fitted: Lithium/Alkaline The following information is available in the EPD:
  - The current battery voltage (see [“Voltages”](#) on [page 46](#))
  - The Battery Low Threshold for each Battery Type (see [“Battery Alarm”](#) on [page 54](#))

The Battery Low Alarm is activated when the battery voltage falls below the appropriate Battery Low Threshold. The EPD will continue to run normally thereafter for a period of at least 8 hours, though this may be shortened by continuous audible alarm output. When the EPD is no longer able to continue correct processing, it enters the Battery Critical State. See [“Battery Alarm”](#) on [page 54](#).

## Confidence Test

There are two different Confidence Tests.

The first Confidence Test is activated whenever:

- The EPD starts up following a battery change.
- The Confidence Test is run using the button (see “Run Confidence Test” on page 47).

The Confidence Test sequence is as follows. This test sequence is automatic and should be visually confirmed as each step initiated:

1. The segments of the display are activated by displaying the “Manufacturer Logo Display” on page 54 (3 seconds) and the “EPD Firmware Version Information” on page 46 (5 seconds).
2. The Confidence Test exercises the complete User Interface, i.e. LCD, Alarm LED, Sounder and Vibe.
3. Once complete, the “Default Display” on page 28 will appear or “Off Mode Displays” on page 53 if it was switched off. This indicates that the Confidence Test has been successfully completed and that the EPD is ready for operational use.

If the Confidence Test is unsuccessful, a Fault will be displayed. Note the failure code(s) and refer to “EPD Faults and Recovery Actions” on page 102.

The second Confidence Test is activated whenever the EPD is switched from EPD Off to ON.

The sequence of the second Confidence Test can be cancelled by pushing on of the buttons and is as follows:

4. The segments of the display are activated by displaying the “Manufacturer Logo Display” on page 54 (3 seconds) and the “EPD Firmware Version Information” on page 46 (5 seconds).
5. The Confidence Test exercises the User Interface, i.e. LCD, Alarm LED and Sounder.
6. Once complete, the “Default Display” on page 28 will appear. This indicates that the Confidence Test has been successfully completed and that the EPD is ready for operational use.

If the Confidence Test is unsuccessful, a Fault will be displayed. Note the failure code(s) and refer to “EPD Faults and Recovery Actions” on page 102.

**Note:** The Confidence Test does not interrupt the normal dose processing if the EPD is in the ON state when initiated. If an alarm condition is raised while the Confidence Test is running, the Confidence Test is abandoned and the normal alarm indication will take priority.

## EPD Faults and Recovery Actions

This section identifies the fault conditions that can occur, where they are logged and describes the recovery procedure (if any) to be taken to restore the EPD to operational use.

The section is organized as follows:

### Contents

- “EPD Faults” on page 102
- “Recovery Procedures” on page 103
- “Other EPD Faults” on page 106

## EPD Faults

An EPD conveys faults to the user in the following ways:

- Fault indications via Sounder, Alarm LED, Vibe and Display LCD - see “[Alarm Indicators](#)” on page 24.
- Communications Error over the IR Communications link - see “[Fault Status](#)” on page 80 and “[Event History](#)” on page 81.
- Failure Notifications on the EPD - see “[Critical Failure Notification](#)” on page 53 and “[EPD Displayed Fault Codes](#)” on page 104,
- The EPD may also fail without producing or displaying an error code, or causing an alarm. A list of such faults and the recommended course of action are listed in [Table 28](#) on page 106.

For recovery, see “[Recovery Procedures](#)” on page 103.

## Recovery Procedures

### Logging Faults / Extracting Data

All faults should be logged using the Fault Log Form (contact Thermo Fisher Scientific - see [“Contacting Us”](#) on [page xv](#)). This form may be used to log single or multiple faults. The completed form should be copied to the manufacturer.

If the unit is in operational use, it is recommended that as much fault and operational data as possible is extracted from the unit, via the LCD and using EasyEPD3. The extent that this is possible will depend upon the nature of the fault. Note that for many faults button/display operation and IR communications are unaffected. This includes many F:nnn codes displayed on the LCD. Data should be extracted and logged as follows:

1. Display fault code or indication (see [“EPD Displayed Fault Codes”](#) on [page 104](#))
2. Internal faults logged in the EPD Status Faults record (see [“EPD Status”](#) on [page 78](#))
3. Contents of internal Event History store (see [“Event History”](#) on [page 81](#))
4. Dose and Peak Dose Rate/time data (see [“Dose and Dose Rate”](#) on [page 77](#))
5. Dose Profile data (see [“Dose Profile”](#) on [page 81](#))

Where possible the data should be obtained as screen dumps or Log files from EasyEPD3 and attached to the completed Fault Log Form.

If a faulty unit is to be returned to the manufacturer, it must be returned in a fully decontaminated and reasonably clean condition. The battery must be removed but kept with the unit. The date of installation of the battery should be specified.

### Clearing faults

The steps required to clear a fault are as follows:

1. Extract data and fault information and complete a Fault Log Form.
2. Identify the fault type in [Table 27](#) on [page 104](#) or [Table 28](#) on [page 106](#) and take the recommended action. This will range from resetting the unit (removing, then replacing the battery), to returning the unit to the supplier (Thermo Fisher or other Supplier or Distributor).

If the unit is to be restored to operational use, clear down all faults on display and in the Fault Status Record, using EasyEPD3. This is to ensure that any subsequent faults are detected.

## EPD Displayed Fault Codes

Faults that exhibit a known condition are normally indicated on the EPD LCD as 'F' followed by a 3-digit error and a brief description of the error. The error code number is also logged in the Event History store, with date/time data. As an example the following shows fault 041:

**Figure 67.** Fault Code Display



**Table 27.** Fault Codes

Code	Text as displayed in EasyEPD3
1	Front End Power Failure
30	FPGA Read Failure
31	FPGA Interrupt Fault
41	Counter Failure HG1
42	Counter Failure HG2
43	Counter Failure SG1
44	Counter Failure SG2
45	Counter Failure SG3
46	Counter Failure FB
70	RTC Failure
71	Dose Processing Failure
88	SounderFailure
100	EEPROM Fault Counters
101	EEPROM Fault Detector Threshold Failure
102	EEPROM Fault Dead Time
103	EEPROM Fault CAQ Options Failure
110	Dose Store Initialization Error
111	EEPROM Fault Dose Processing Options
112	EEPROM Fault Sensitivity Gains
113	EEPROM Fault Alarm Thresholds
114	EEPROM Fault Dose Rate Filter
130	EEPROM Fault UI Configuration
131	EEPROM Fault UI Display Enables
132	EEPROM Fault UI Alarm Configuration



**Table 27.** Fault Codes

Code	Text as displayed in EasyEPD3
130	EEPROM Fault UI Alarm Locks
200	Early Communications Failure

For further information, contact Thermo Fisher Scientific (see [“Contacting Us”](#) on [page xv](#)).

## Other EPD Faults

**Table 28.** Faults associated with EPD Hardware

Symptoms	Likely Cause	Diagnosis	Repair Instructions
<b>Faulty LCD</b>			
Nothing displayed on the LCD, not even 'Heart Beat' indication	Battery Failure	Attempt to communicate with the EPD using EasyEPD3 to check if EPD can be read.	Remove old and insert new battery. Follow instructions from <a href="#">“To Insert/Replace the EPD Battery”</a> on <a href="#">page 14</a> . Check the EPD using EasyEPD3 again. If failure, see next step.
Nothing displayed after new battery replaced.	Battery hatch not corrected seated	Check seating on battery hatch.	Remove and replace battery hatch. Follow instructions from <a href="#">“To Insert/Replace the EPD Battery”</a> on <a href="#">page 14</a> . Check the EPD using Easy EPD3 again. If failure, see next step.
Nothing displayed after Battery hatch re-seated	Battery out of specification	Use a recommended battery.	Replace the battery with a recommended Battery. Follow instructions from <a href="#">“To Insert/Replace the EPD Battery”</a> on <a href="#">page 14</a> .
Missing characters/pixels on LCD display	LCD Display faulty	Confirm fault by running a Confidence Test (follow instructions <a href="#">“To Run Confidence Test”</a> on <a href="#">page 47</a> ).	
<b>Faulty LED</b>			
Missing characters/pixels on LCD display	LCD Display faulty	Confirm fault by running a Confidence Test (follow instructions <a href="#">“To Run Confidence Test”</a> on <a href="#">page 47</a> ).	If failure, return to manufacturer.
Alarm LED fails to operate in alarm condition.	LED disabled in Alarm configuration	Using EasyEPD3, check that the Alarm LED has been enabled for the Alarm condition.  If enabled and Alarm LED not working, go to next step.	No Action.

**Table 28** Faults associated with EPD Hardware

Symptoms	Likely Cause	Diagnosis	Repair Instructions
No LED during Confidence Test	LED faulty	Confirm fault by running a Confidence Test (follow instructions <a href="#">“To Run Confidence Test”</a> on <a href="#">page 47</a> ).	If failure, return to manufacturer.
Backlight fails to operate when buttons pressed	Backlight not enabled	Using EasyEPD3, check that the backlight has been enabled.	If failure, see next step.
Backlight not working (when enabled)	Backlight faulty		If failure, return to manufacturer.
<b>Faulty Sounder</b>			
Sound fails to operate in alarm condition	Sound disabled in Alarm configuration	Using EasyEPD3, check that the sound has been enabled for the Alarm condition.  If enabled and Sounder not working, go to next step.	No Action.
Sounder not working	Sounder faulty	Confirm fault by running a Confidence Test (see <a href="#">“To Run Confidence Test”</a> on <a href="#">page 47</a> ).	If failure, return to manufacturer.
<b>Faulty Vibe</b>			
Vibe fails to operate in alarm condition	Vibe disabled in Alarm configuration	Using EasyEPD3, check that the vibe has been enabled for the Alarm condition.  If enabled and vibe not working, go to next step.	No Action.
Vibe not working	Vibe motor faulty	Confirm fault by running a Confidence Test (follow instructions <a href="#">“To Run Confidence Test”</a> on <a href="#">page 47</a> ).	If failure, return to manufacturer.
<b>Faulty Button</b>			
Cannot mute alarm using buttons	Muting Disabled	Using EasyEPD3, check that mutable has been enabled for the Alarm condition.  If enabled and mute not working, go to next step.	No Action.

**Table 28** Faults associated with EPD Hardware

Symptoms	Likely Cause	Diagnosis	Repair Instructions
No response to button	Buttons faulty	Attempt to use buttons to navigate the menu.	If failure, return to manufacturer.
<b>Clip Damage</b>			
Clip threaded fixing damaged	Over screwing the clip screw	Clip screw does not hold.	If failure, return to manufacturer.
Clip plastic damaged	Clip Damaged		If failure, replace clip.
Clip spring overstressed	Clip Spring Damaged		If failure, replace clip.
<b>Battery Hatch</b>			
Battery Hatch threaded fixing damaged	Over screwing the Battery Hatch screw		If failure, return to manufacturer.
Battery Hatch gasket damaged or loose	Case Gasket Damaged		If failure, replace battery hatch.
<b>Case Damaged</b>			
Case plastics broken or damaged	Case Damaged		If failure, return to manufacturer.
Case gasket damaged or loose	Vibe motor faulty		If failure, return to manufacturer.
Infrared Interface window scratched or damaged	Infrared Interface window damaged		If failure, return to manufacturer.
Alarm LED window scratched or damaged	Alarm LED window damaged		If failure, return to manufacturer.
LCD Window damaged or cracked	LCD Window damaged		If failure, return to manufacturer.
Lanyard fixing damaged or missing	Lanyard fixing damaged		If failure, return to manufacturer.
<b>Faulty Beta Window</b>			
Beta Window punctured or damaged	Beta Window damaged by sharp object		If failure, return to manufacturer.



## Glossary

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

**/h** Per hour

**°C** Degrees Celsius

**μSv** Micro-Sievert. One millionth of a [Sv](#)

**<sup>90</sup>Sr** Strontium-90

**<sup>137</sup>Cs** Caesium-137

**<sup>147</sup>Pm** Promethium-147

**<sup>241</sup>Am** Americium-241

### A

**ADS** Approved Dosimetry Service.

**AN** Albedo Neutron. The fraction of incident radiation reflected by the body.

**API** Application Programming Interface – a set of functions which are made available to an application to perform certain tasks.

**AWP** The data link level protocol used by [EPD](#) and the [DLL](#)

### B

**Baseline** A snapshot of the counter values. Used to calculate the counts received since the last Counts Clear by subtracting the snapshot from the present count values.

**BC** Beta Compensating

**BLE** Bluetooth Low Energy. The wireless

technology used for [EPD](#) Trudose.

### C

**CE** Conformité Européene or European Conformity

**Chrome** The window borders, scroll bars and other user interface elements in an application.

**CRC** Cyclic Redundancy Check. Error checking code.

### D

**dB(A)** Decibels - A' weighted scale (sound intensity)

**DC** Direct Current

**DDE** Deep Dose Equivalent. See [Hp10](#)

**DLL** Dynamic Link Library. A library of functions which can be loaded for use in an application.

**DTR** Desktop Reader

**Dose** The accumulated Dose to which alarm thresholds apply, intended for tactical Dose monitoring (e.g. per day, per week, per shift etc)

**DP** decimal places

### E

**EasyEPD3** A program for reading and writing a single [EPD](#).

**EEPROM** Electrically Erasable Programmable Read Only Memory

**EPD** Electronic Personal Dosimeter

**EPD TruDose-BG** Latest version of the [EPD](#) which measures and displays [Hp10](#) and [Hp07](#) Dose Equivalents from Beta and Gamma sources.

**EPD TruDose-G** Latest version of the [EPD](#) which measures and displays [Hp10](#) and [Hp07](#) Dose Equivalents from Gamma sources.

**eV** Electron Volt

## F

**FB** Full Beta (including Photons)

**FEM** Front End Module

**FN** Fast Neutron

## G

**Gy** Gray, SI unit of Dose

## H

**H** Dose

**H** Dose Rate

**HCI** Human Computer Interface

**HEX** Hexadecimal

**HG** Hard Gamma

**Hp07** Personal Dose equivalent at a depth of 0.07 mm of tissue ( 'superficial' , 'shallow' or 'skin' Dose).

**Hp10** Personal Dose equivalent at a depth of 10mm of tissue ( 'penetrating' , 'deep' or 'wholebody' Dose).

**Hp10/h** [Hp10](#) Dose Rate

**Hp07/h** [Hp07](#) Dose Rate

**HPA** Health Protection Agency in the UK -- the statutory authority for radiological protection in the UK. (Previously [NRPB](#))

## I

**ICRU** International Commission on Radiation Units

**ID** Identification

**INF file** Device Driver Information file

**Ir** Infra-red

**IrDA** Infrared Data Association

## K

**keV** Kilo Electron Volt

## L

**Latched Alarms** Alarms that, once activated, have to be manually cleared using the IR Communications link e.g. Dose Rate Overrange

**LCD** Liquid Crystal Display

**LED** Light Emitting Diode

**Long-Click** Defined as a press and release where the period that the button is pressed for is > 2000ms

**LRU** Lowest Replaceable Unit

**LTC** Lithium Thionyl Chloride (Sulphurous Oxychloride,  $\text{SOCl}_2$ )

## M

**MCU** Microprocessor Control Unit **Measurement quantity** [Hp10](#), [Hp07](#)

**MeV** Mega Electron Volt

**m** metre/milli

**mm** millimetre

**ms** milli-seconds

**mrem** imilli-rem. One thousandth of [rem](#)

**mSv** milli-Sievert. One thousandth of [Sv](#)

## N

**NC** Neutron Compensating

**nm** nanometer

**NPP** Nuclear Power Plant

**NRPB** National Radiological Protection Board

(now [HPA](#))

**N** Neutron

## P

**PC** Personal Computer

**PCB** Printed Circuit Board

**PTB** The Physikalisch-Technische Bundesanstalt, Braunschweig and Berlin, is the national institute of natural and engineering sciences and the highest technical authority for metrology and physical safety engineering of the Federal Republic of Germany.

**ppm** Parts per million

**PRU** Personal Radio Unit

**PTB** The Physikalisch-Technische Bundesanstalt, Braunschweig and Berlin. The national institute of natural and engineering sciences and the highest technical authority for metrology and physical safety engineering of the Federal Republic of Germany.

## R

**RAM** Random Access Memory

**Rate** Dose Rate

**rem** A unit of Dose equivalent, equal to 10mSv

**Responder** *Manufacturer-enabled* [EPD](#) which accumulates does after a Dose Rate alarm has occurred. In the UK used by some First Line Responder Personnel (hence the name Responder).

**RFI** Radio Frequency Interference

**RH** Relative Humidity

**ROHS** Restriction of Hazardous Substances

**RTC** Real Time Clock

**RTOS** Real-Time Operating System

## S

**SDE** Shallow Dose Equivalent. See [Hp07](#).

**SG** Soft Gamma

**Short-Click** Defined as a press and release where the period that the button is pressed for is between 200 and 2000 ms

**Sv** Sievert, SI unit of Dose equivalent

## T

**T** Tesla

**Task ID** A numeric code of up to 32 characters that may be written to the [EPD](#) to define the current Task ID.

**Task Name** A character string of up to 32 characters that may be written to the [EPD](#).

**TruDose™** Thermo Fisher Scientific [EPD](#) TruDose

**TLD** Thermoluminescent Dosimeter

**Total Dose** Intended to be a secure record of the total accumulated Dose received since [EPD](#) issue - alarms do not apply to total Dose.

## U

**USB** Universal Serial Bus

**User ID** Alternative terminology for the [Wearer ID](#).

**User Name** Alternative terminology for the [Wearer Name](#).

**UTC** Coordinated Universal Time

## V

**VID** Vendor ID (Unique ID allocated to every USB product vendor)

**Void** No Value

## W

**Wearer ID** A numeric code of up to 32 characters that may be written to the [EPD](#) to define the current Wearer ID. There are three Wearer IDs available.



**Wearer Name** A character string of up to 32 characters that may be written to the [EPD](#).

**WEEE** Waste Electrical and Electronic Equipment (EU Directive)

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**IndexFehler!** Verwenden Sie die Registerkarte 'Start', um Heading 1 dem Text zuzuweisen, der hier angezeigt werden soll.: **Fehler! Verwenden Sie die Registerkarte 'Start', um Heading 4 dem Text zuzuweisen, der hier angezeigt werden soll.**

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